Powdered Coal Hazards

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Coal dust explosions have taken place since the beginning of mining of bituminous coal, but such explosions were always attributed to gas and not dust.

The controversy on the explosibility of coal dust is interesting and particularly to safety men because it shows how difficult it is to uproot an old ingrown idea.

Let us follow step by step the investigations that were carried on during more than one hundred years from almost the first time mention was made of coal dust as an explosive in itself until the time, only a few years ago, when this point was conclusively proved.

In the published account of an explosion in a coal mine at Wallsend, England, on September 3, 1803, J. Buddle, chief of the Newcastle coal miners says: "The workings were very dry and dusty and the survivors who were most distant from the point of explosion were burnt by the shower of red-hot sparks of ignited dust which were driven along by the force of the explosion."

Professor Faraday, the famous chemist and physicist, remarked in his report on the Haswell mine explosion September, 1844: "In considering the extent of the fire from the moment of explosion it is not to be supposed that fire damp was its only fuel. The coal dust swept by the rush of wind and flame from the floor, roof and walls of the works would instantly take fire and burn if there were oxygen enough present in the air to support its combustion."

Various investigations were made in England, but up to 1880 the explosiveness of coal dust had made little progress. On September 8, 1880, a terrible explosion occurred at the Seaham mine, County of Durham, England, which attracted general attention to the subject of coal dust. Professor Frederick Abel was commissioned to make some experiments with coal dust. In his report he said: "In the complete absence of fire damp, coal dust exhibits some tendency to become inflamed when passing a very large lamp flame at a very high velocity. If exposed to the action of a large volume of flame it exhibits a decided tendency to propagate flame. But so far as can be determined by experiments on a moderate scale, this tendency is of limited nature." Professor Abel in giving evidence at the Seaham inquest also said, "if coal dust alone would have exploded every colliery would have been wrecked long ago."

The British Accidents in Mines Commission began its sitting in 1879, but did not make its final report until 1886. In a preliminary report issued in 1881, the evidence of practically all the expert mining witnesses except that of Mr. Hall and Mr. Galloway—who both for several years had conducted experiments with coal dust—was to the effect that it was improbable that coal dust would do more than increase the range of a fire-damp explosion. Even Mr. Galloway tesitified March 18, 1880, that it was necessary to have a slight amount of gas present to explode coal dust. In 1884 Mr. Galloway took a more positive stand in stating in a paper on coal dust that no earlier author than himself had credited coal dust with being a principal factor in mine explosions, relegating fire damp to a secondary place.

In other countries, particularly France, Germany and Austria, investigations had gone on simultaneously with those in England, but as here without definite results.

On March 15, 1886 the British Accidents in Mines Commission reported the following facts as conclusively established:

> 1. The occurrence of a blown-out shot in working places where very highly inflammable coal dust exists in great abundance may, even in the total absence of fire damp, possibly give rise to violent explosions, or at any rate be followed by the propagation of flame through very considerable areas and even by the communication of flame to distant parts of the workings where explosive gas mixtures, or dust deposits in association with non-explosive gas mixtures, exist.
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> 2. The occurrence of a blown-out shot in localities where only small proportions of fire damp exist in the air, in the presence of even comparatively slightly inflammable or actually non-inflammable but very fine dry and porous dust, may give rise to explosions, the flame from which may reach distant localities where either gas accumulations or deposits of inflammable coal dust may be inflamed, and may extend the disastrous results to other regions."

It will be observed that this report shows a great change of sentiment from the time of the preliminary report in 1881. The report led to an enactment by Parliament in 1887, requiring certain precautionary measures to be used in dusty mines.

Despite the affirmative report there was not then any general acceptance among mining men of the explosibility of coal dust itself so that in 1890 Henry Hall, government inspector of mines, was commissioned to make some further experiments on a large scale in certain disused shafts with coal dust from various mines. Some of these tests were very spectacular. In describing the seventh test it is said, "dust was ignited followed by a continuous roar and a rush of flame completely filled the pit mouth and ascended 60 feet into the air. This was the most violent explosion since the commencement of the experiment. It is difficult for anyone who did not witness this experiment to realize the extent of the explosion. The flame continued to issue from the pit for five to six seconds, followed by dense smoke. The violence carried away some of the woodwork 37 feet above the pit mouth."

Mr. Hall in his summary states: "These experiments conclusively prove that blasting with gunpowder in dry and dusty mines may cause serious disasters in the entire absence of fire damp."

In February, 1891, a Royal Commission on explosions from coal dust in mines was appointed and began hearing evidence. In its final report the Commission summarized their conclusions in the following words:

> 1. The danger of explosion in a mine in which gas exists, even in very small quantities is greatly increased by the presence of coal dust.
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> 2. A gas explosion may be intensified and carried on indefinitely by coal dust raised by the explosion itself.
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> 3. Coal dust alone, without the presence of any gas at all may cause a dangerous explosion if ignited by a blow-out shot or violent inflammation. To produce such a result, however, the conditions must be exceptional, and are only likely to be produced on rare occasions.
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> 4. Different dusts are dangerous in varying degrees, but it cannot be said with absolute certainty that any dust is entirely free from risk.
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> 5. There appears to be no probability that a dangerous explosion of coal dust alone could ever be produced in a mine by a naked light or ordinary flame.

A new Royal Commission on Mines was appointed in 1906. This commission, while taking up all questions relating to mines, gave a great deal of attention to coal dust. The general interest in the subject led the Mining Association of Great Britain to establish in 1908 a testing gallery of unusual dimensions at the Altofts mine in Yorkshire. In its report of September, 1909, the Commission says:

> The witnesses, who included those best qualified from scientific or practical experience to speak on the question, expressed opinions which were often widely divergent, as to the best means of meeting

> the danger of explosions, but they were generally agreed on two points—that coal dust is liable to explosion with or without the presence of fire damp, under conditions which are at present to be found in most coal mines in this country and abroad, and that there is pressing need for the elucidation of the problems involved by a series of exhaustive experiments on an adequate scale. With regard to the first point, it was a matter of satisfaction to us that all the witnesses whom we consulted expressed themselves as adherent to the received opinion on the question of coal dust. In this respect we found ourselves in a better position than the commissions who preceded us in that we were able to confine our attention to the means of dealing with coal dust without having to prove the necessity for such means. We do not mean to convey the impression that all managers and mining engineers are fully alive to the danger of coal dust. Unfortunately, recent occurrences have tended to show that this is not the case. If such is the position taken by some managers in this country, it is the less surprising that the workmen do not all appreciate the danger of coal dust.

At this point it is of interest that, undoubtedly due to the investigations, the annual death rate from explosions of fire damp or coal dust in England decreased from 1.280 per 1,000 during the period 1851-1855 to 0.057 per 1,000 in 1907. In other words, considering an equal number employed while 22 men killed by fire damp or coal dust in 1851-1855 only 1 was killed in 1907.

One of the earliest recorded dust explosions in the United States was in a grahamite mine in Ritchie County, W. Va., on February 9, 1871, when 4 men were killed. A second explosion took place in the same mine February 25, 1873, also killing 4 men.

On March 13, 1884, occurred the first great mine explosion of the bituminous fields of this country, at the Pocahontas Mine in West Virginia. There were 114 men killed, all who were in the mine. A committee appointed by the American Institute of Mining Engineers made a careful examination. Some of the contributing causes found were as follows:

A. The very large quantity of dust in extremely fine state of division.
B. The use of excessive quantities of powder largely increased the amount of dust.
C. The employment of incompetent and inexperienced men.
D. The failure to recognize and appreciate the previous warnings of danger given by flashing of unusual extent, when shots were fired, indicating the need of special precaution.

For some years after the Pocahontas explosion the coal dust problem attracted little attention in this country and operating men were content to await the results of experiments abroad. Each was chiefly concerned in his own part in the tremendous development going on in the various great bituminous fields.

Interest in coal dust reawakened when explosions began to occur in mines in the western region, particularly in Iowa. Many of these explosions were in shallow mines in which fire damp had never been found before the explosions and was not found after them.

Although explosions occurred from time to time in various sections of the country it was not before 1907 that we had an appalling series of great wide-sweeping disasters. On January 23 of that year an explosion occurred at the Primero Mine, Colorado, with 24 deaths. On January 26 another at the Penco Mine, W. Va., with 12 deaths. On January 29 at the Stuart Mine, W. Va., 90 deaths. On February 4 at the Thomas Mine, W. Va., 25 deaths. On December 1 at the Naomi Mine, Pa., 35 deaths. On December 6 at Monongah Mines, W. Va., occurred what is probably the greatest disaster in the history of coal mining in the United States, when 358 lives were lost. On December 16 at the Yolanda Mine, Ala., 56 men were killed and on December 19 at the Dorr Mine, Pa., 230 men were killed. In this black month of December, 648 men were sacrificed, chiefly from the effect of coal dust, which if not the initial cause in all cases was the agent carrying death.

The coal dust question in this country cannot be said to have awakened wide-spread interest until the terrible disaster of December, 1907. In response to a demand by those interested in coal mining throughout the country, Congress, in 1908, made an appropriation for an investigation of mine explosions. A testing station was at once decided upon and was established at Pittsburgh, Pa.

While it is probable that for several years the leading mining men in this country believed in the explosibility of coal dust without the presence of fire damp, yet, until the public demonstrations were given at the testing station at Pittsburgh during 1908-1909 and reports were received of similar tests made abroad a large proportion disbelieved.

The question of the day is no longer "Will coal dust explode?" but "What is the best method of preventing coal dust explosions?"

In coal mining there is a diversity of opinion as to what the term "coal dust" means; that is, how finely coal must be divided to be termed dust. Coal dust that will pass through 100-mesh screens is frequently accepted as mine dust. This fineness was adopted at the Pittsburgh testing station as standard. It must not be thought, however, that there is no danger in coarser dust. At Pittsburgh it has been demonstrated that propagation can be obtained with dust that will pass the 20-mesh screen.

In mines dust is a waste product and much is done to prevent its formation. In the cement industry coal dust is a manufactured product and its fineness is high, at least 80 % passing the 200-mesh screen, which is equivalent to dividing a cubic inch of coal into about 8,000,000 pieces.

It is a well known fact that when we start a fire the rapidity of combustion depends upon the surface exposed to the air. For this reason we chop our wood fine and see that there is a good draft when we kindle a fire in our stove.

An explosion is in reality nothing but rapid combustion made possible by the material being finely divided and the presence of enough oxygen to support combustion. In explosives such as dynamite and gunpowder, the oxygen is supplied artificially through the chemical composition of the explosive material.

If we take a cubic inch of coal and ignite it it will burn very slowly even under the best air supply conditions. But if we take another cubic inch of coal and divide it into 8,000,000 pieces, supply air and ignition, then combustion of all the pieces will take place simultaneously and we have what we call a coal dust explosion.

While the idea of using powdered coal for fuel is not entirely new—we hear of experiments having been made with it as early as in 1818—it can truly be said that it was not before its application in the cement industry in this country that its use was considered with any degree of seriousness. Prior to 1897 all cement was burned with oil. Mr. Hurry, engineer and Mr. Seaman, superintendent at the Atlas Portland Cement Company's plant at Northampton, Pa., after much experimentation introduced powdered coal into the cement industry in that year. Its use in other industries is rapidly increasing and during the last three or four years quite a few power plants have made use of it as boiler fuel.

The cement industry is the fourth largest industrial consumer of coal in the United States and by far the largest user of pulverized coal. The annual consumption of coal by the cement industry is exceeding 8,000,000 tons, of which more than 5,000,000 tons are pulverized and used in the kilns.

Having handled vast amounts of this dangerous material since the time when coal mining people were still disputing the fact that coal dust would explode without the presence of gas it is not surprising that we have records of quite a few accidents. That we do not have more can be attributed to the vigilance continually exercised in the cement industry against this hazard.

In the early years of the cement industry the coal mills were not so constructed that they could be kept clean without some effort and that undoubtedly is one of the reasons for several explosions at that time. Many coal houses have since been remodeled and new ones have been built so that, in respect to housekeeping, improvements have been continuous.

The coal mill should be in a separate building of fireproof construction, well ventilated and well lighted, both artificially and by daylight. Too much thought cannot be given to the design of new coal mill buildings or to remodeling and changing of old existing buildings.

Without going into detail, it should be stated that the drier room should be entirely separate from the mill room by a fireproof wall; that this has not been done universally has been the reason for several explosions and fatal accidents.

The entire building should be of fireproof material; all walls should be smooth with no projections of any kind, and the design should be such that beams, trusses, etc., can be entirely eliminated. Platforms and stairway should be of metal of some open designs such as subway grating so as to prevent the lodging of dust. To increase light and cleanliness it is a good plan to paint the coal house white inside.

The motors driving the grinding mills should as far as possible be placed in a special room separated from the mill room by a fireproof wall and emergency stop buttons should be placed outside the building as well as at various places in the mill room.

The grinding mills should be dustless and all screw conveyors and elevators should be so constructed that little or no dust can escape. In designing a new coal mill, provision should be made to place all conveyors except the one carrying the coal dust from the grinding mills, and elevator stacks on the outside of the building.

Coal dust explosions at cement plants have taught us that we have several outstanding danger points to watch with particular care.

1. Cleaning of coal houses is dangerous because if the men performing this work are not extremely careful, it is very easy to stir up just enough dust to produce that critical mixture of dust and air which will cause an explosion even with the slightest spark. This spark may be generated by the coal itself through spontaneous combustion, or by careless handling of electrical equipment, or by the fire in the drier if the previously mentioned precaution of separating the driers from the mill room by a fireproof wall has not been taken. Many lives have been lost in explosions which took place while mill rooms were being cleaned, the most horrible example being an explosion in 1911 in which nine out of ten men cleaning a coal house were burned to death. Many dust explosions occur in two stages—first a primary explosion, which is usually local; and second, a much more extensive and destructive explosion which results from the disturbance of the accumulated dust by the first explosion. When an explosion occurs in a clean plant where proper dust control methods are in use, nothing more serious than local damage usually results, but in a dirty plant the explosion may be propagated from point to point and result in extensive destruction of property and serious loss of life.

2. Numerous explosions have occurred while repairs have been made on some part of the coal house machinery. During such work it is very easy to dislodge a considerable amount of dust and the danger is enormously increased because the repairmen frequently need an artificial light close at hand. The danger is still further increased by the fact that many repairmen do not seem to have been instructed in the danger of coal dust. Not very long ago, we received a report of an explosion which took place while a repairman worked on an elevator in the coal house with an open torch. Incredible as it may seem, this practice is not uncommon and the conclusion must be drawn that the men have no knowledge of the danger to which they expose themselves and others. Needless to say that if artificial light is necessary, only an electric flash light or a fully enclosed and protected incandescent light must be used.

3. Carelessness in operating the coal mill is another point of danger. It may be carelessness or ignorance or a combination of both that sooner or later leads to trouble.

The coal drier which is found in the coal mill of every cement plant is entitled to the most careful attention because of the possibility of overheating the coal while it passes through the drier. The only way to keep close check on this danger is to take regular temperature readings; in fact, a recording thermometer should be used. Frequently coal houses are dustier than necessary because conveyors, elevators, grinding mills and other equipment are not kept in proper, dustproof condition. A conscientious mill operator with any regard for his own and his fellow-workmen's safety will not permit such conditions to exist.

It is well for the coal mill operator to remember that many of those explosions for which there are no proved causes have occurred immediately upon starting the machinery after a shutdown. The explanation to this may be that coal was overheated in the drier during the shutdown or that the coal dust in some part of the system was ignited spontaneously. Many grades of coal will develop spontaneous combustion with unbelievable rapidity under such conditions as are present after even a short shutdown. Undoubtedly the most severe coal dust explosion in the history of the cement industry occurred some twenty years ago under such conditions. A small fire was discovered in an elevator. The fire was smothered by throwing pulverized stone dust over it. After a short time it was thought that the fire was out and the elevator was started up. Immediately a terrific explosion took place killing a dozen men.

The danger of coal dust presents itself not only in the coal mill proper, but also in the kiln building where the fuel is used. The coal conveyors and tanks should be given the same careful attention that similar equipment is given in the coal house. The conveyor should be tight and care should be taken that the tanks do not overflow. In the kiln room there is the added danger due to the ever present fire in the kilns. A number of severe accidents have been caused by coal dust being ignited either from the kiln directly or from the hot clinker.

Quite a few cement plants have never experienced a coal dust explosion. We like to believe that this is due to careful operation. There is, however, also reason to believe that at some of those plants coal is used which is not highly explosive. It is a well known fact that no two kinds of coal are of the same chemical combination. One kind may be highly explosive in pulverized form and another may be almost non-explosive under normal working conditions. The contents of volatile matter has a very important bearing on the explosibility of coal. Coal containing 32 % and over of volatile matter is particularly dangerous and the danger generally increases with the percentage. From this we must, however, not draw the conclusion that there is such a thing as coal dust which will not explode. All coal dust will explode under favorable conditions and to prevent accidents at cement plants this fact must be impressed upon the men.

In no department of a cement plant does the human element play a more important role than it does in the coal mill and education of the men to a proper realization of the dangers involved so they will handle coal dust with the same respect and care that they would give to dynamite, is necessary if coal dust explosions are to be prevented.

The Giant Portland Cement Co. of Egypt, Pa., has placed a new kiln in operation, one of the largest in the Lehigh region.

British Foreign Trade in Cement

By Alfred Nutting
Clerk in the American Consulate-General, London, England

Imports of cement into the United Kingdom during the nine months to September, 1923, amounted to 112,886 tons of 2240 lbs., contrasted with 96,849 tons in the same period of 1922, and 79,343 tons in 1921. During the nine months of 1922 and 1923 the average import price has steadily declined; in 1921 it reached just over £5 per ton, £3:8s:6d in 1922, and slightly below £2:14s:0d. in the current period. The values in each year (9 months) were as follows: 1921—£398,016; 1922—£331,689; 1923—£302,779. The official monthly returns of British trade do not disclose countries of origin, but the bulk of the imports come from Belgium.

British Exports Increase by Nearly 40%

Compared with the nine months in 1922, British exports in 1923 were nearly 40% greater, aggregating 389,309 tons, against 278,582 tons. In 1921 the aggregate amounted to 231,282 tons, the average export price of which was £6 per ton, falling to £3:7s:5d. in 1922, and further to £2:14s:1d in the current period.

Exports in 1923 were larger than in 1921 to all destinations except Argentina and New Zealand, and exceeded those for 1922 to all countries other than Australia.

The following statement gives details of exports by destinations, for the nine months of 1922 and 1923; it will be seen that there was considerable disparity in the price per ton, exports to the Netherlands coming out at less than £2 per ton, while to some other countries the rate was higher than the average for aggregate exports:

	Quantities		Values	
	1922 Tons	1923 Tons	1922	1923
Netherlands...	16,947	32,741	£31,528	£51,626
France.......	74	86	957	278
Brazil........	19,065	24,105	60,204	66,881
Argentina.....	1,149	3,633	2,939	9,693
Br. S. Africa..	13,283	19,464	40,712	47,631
Br. East Indies	94,107	101,793	348,111	287,184
Australia.....	28,859	17,581	90,603	48,188
New Zealand..	679	1,694	4,080	5,548
Other countries	104,419	188,212	259,768	534,936
Total.........	278,582	389,309	£938,902	£1,052,165

Alleged New Control of the British Cement Trade and Denial

As previously reported, there have been rumors from time to time during the present year to the effect that interested American parties were acquiring Associated Portland Cement Co. shares on the market with the object of securing control of this organization, which holds a practical monopoly of the British industry; but no confirmation of these statements has been forthcoming.

In its issue dated November 7th, 1923, however, the London *Daily Express* published, under heavy head lines, a statement to the effect that a concern entitled the Associated Anglo-Atlantic Corporation ("the object of whose recent formation has been a City mystery for the past two months") had succeeded in acquiring a majority holding giving the corporation control, and details of alleged operations by which this result had been obtained.

The London *Morning Post* of November 8th, publishes a letter from the Associated Portland Cement Company, as follows:

Sir:

The attention of my board has been drawn to the article in today's issue of the *Daily Express* headed a "City Bombshell," in which it is stated, amongst other things, that the control of their undertaking has been taken from them and that the cement industry of this country has passed into the hands of another company. It is also stated that this has happened without the knowledge of my board. These statements are directly contrary to the actual facts, and seem to call for contradiction by my directors. My directors have long been aware that considerable purchases of the Ordinary shares of the Company have been made by a financial group, with whom they have for some time been in friendly communication, but the total holding of such group, which has been disclosed to us, can in no sense be described as affording control of our company, even if such had been the object of the group. I may add that the two gentlemen mentioned in the article have informed me that it has been published without their knowledge or approval.

C. St. Leger Brockman,
Secretary, Associated Portland Cement Manufacturers, Ltd.

Commenting on the foregoing, the *Morning Post* adds:

Meanwhile we are also favored from another source with a great deal of further information about the cement industry. We are told, for instance, how that, in spite of the good quality of home cement, the industry has remained stationary, and we are pointed to the United States as an example of what a little hustle and up-to-date machinery will do in the way of increasing output. Following upon this introduction, the formal and very interesting statement is made that a new financial enterprise has been registered by "leading financial and business men" which is entitled the Associated Anglo-Atlantic Corporation, Limited, with a capital of £1,000,000, which is being privately subscribed. It will have, we understand, as Chairman, Sir Philip Nash. . . . well known in connection with the quite important companies with which he is associated, and the names of the other members of the board will be awaited with interest.

The London *Daily Express* publishes no denial from Mr. Brockman (given above) in its issue for November 8th. and is discreetly silent on the subject.

Michigan to Operate Cement Plant

Arrangements have been made whereby the State of Michigan will lease for a period of 5 years, the plant of the Michigan Portland Cement Co. at Chelsea, Mich. The plant at Four Mile Lake, Mich., is a wet process plant using coal for burning. Preparations are being made to house approximately 80 men from the Jackson prison with whom it is proposed to operate the plant.

It is reported that the plant will be surrounded by a high wire fence similar to that surrounding other prison institutions and a staff of prison officials will be located at Chelsea near the plant as soon as the barracks to house the men are completed.

It is planned to increase the production at the plant, immediately, to approximately 800,000 bbls. annually, and to further increase the capacity of the plant within the next year. The estimated needs of the State Highway Department for road and bridge construction are approximately 2,000,000 bbls. of cement for the year 1924.

American Cement in Greece

Under the Grecian customs regulations which have recently become effective, allowing the free importation of building materials to be used in the reconstruction of the portion of the city burned in 1917, a trial order of American cement has arrived. This cement was sold by the importer at a lower price than cement prepared in Greece. If consumers are satisfied with the quality, it is possible, according to New York reports, that a permanent market will be developed, unless exchange conditions again become so unfavorable as to prohibit buying in foreign markets any materials which are produced locally.

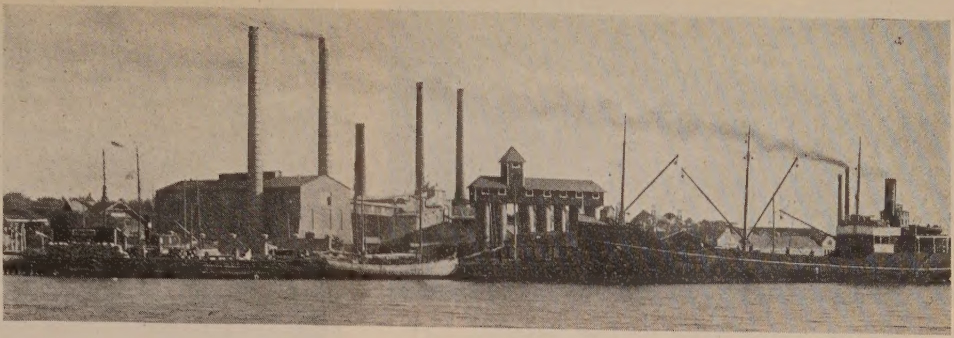


Fig. 1—View of the Öland Cement Company's Plants at Degerhamn Showing the Cement Plant and the Lime Burning Plant

Oil Shale Industry in Sweden 200 Years Old

The Öland Cement Company's Ancient Plants Based Upon Oil Shale Burning at the Side of a Modern Cement Plant

By Dr. Frans Killig
Superintendent Öland Cement Co.
Degerhamn, Sweden

Sweden has no coal deposits of value. In the cretaceous system of Scania there are certainly some small deposits, but they are too insignificant for supplying more than a small fraction of the country's requirements of coal for industrial purposes.

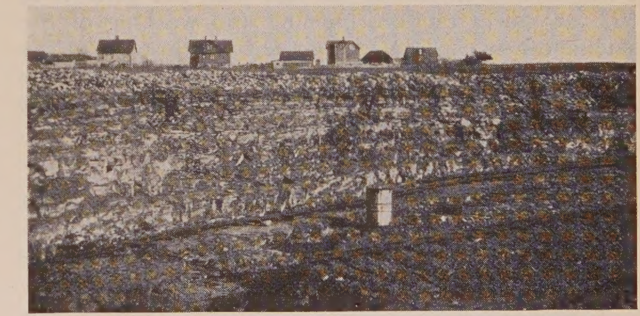
Efforts have been made for many years past to make Sweden independent of imported coal by utilizing the native fuel and power resources of the country, of which the principal are wood, peat, oil-shale and water power. Shale has the lowest heating value of the above mentioned fuels, and Swedish shale, moreover, is of less value than that of other countries for such purposes. In spite of this fact there is no country where shale has come into such general use, and is used for so many different purposes as in Sweden. The shales found there belong to the Cambrian system, and appear in rather large deposits in the south and north of Sweden. Their value is dependent on a comparatively small and varying percentage of organic, combustible substances, which are in part converted into mineral oils at dry distillation. The following table gives a summary of the Swedish shale varieties and their calorimetric value:

Province	% Oil	Calorimetric Value
Skäne (Scania)	0	460—1448
Östergötland	2.45—7.45	1100—2600
Västergötland	0.83—8.01	360—2290
Närike	3.00—6.60	2030—2680
Öland	2.40—4.33	1290—1700
Norrland	0	90— 800

As a natural consequence of the lack of high-grade fuel in the country, all of these shale formations, the value of which has been recognized since ancient times, have in the course of centuries been turned to practical use to a greater or lesser extent. Several industrial enterprises have been built up on the basis of this raw material, but the only ones remaining are those of Östergtöland, Västergötland, Närike and Öland At these places the industries concerned have attained quite a development and importance.

As the manner of using the shale is practically the same at all these places in spite of the difference in valuable properties, only the Öland shale will be treated in this review. It is true that the shale is the poorest, but the industry in Öland is the first, with a 200-year old history behind it.

The island of Öland lies in the Baltic Sea near the



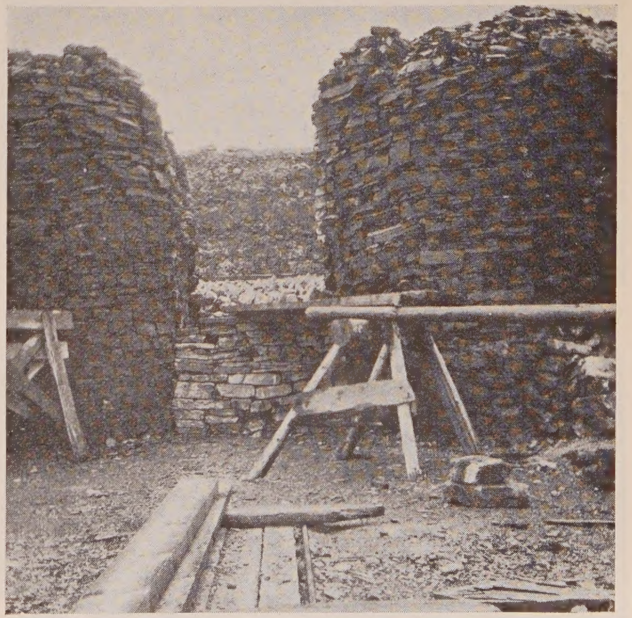


Fig. 2—The Shale Quarry
Fig. 3—A Clamp During Construction and Charging·

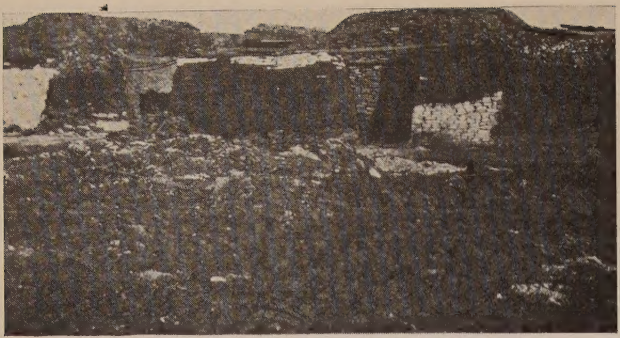


Fig. 4—A Range of Clamps Ready for Lime Burning

Swedish east coast. It is 137 kilometers long and from 3 to 16 kilometers across, being built up of Cambrian shale overlaid with Silurian limestone. The shale formation is largest in the southern part of the island, in the neighborhood of Degerhamn. The slate layer is of 11 to 12 metres thickness and consists in part of oil-shale, and in part of benches of limestone imbedded in the shale, the latter comprising about one third of the entire deposit. The slate is of greyish-black color and hard, and may easily be extracted in large slabs. It has been used, and is still used for some of the following purposes, viz.: (1) alum production; (2) for burning lime; (3) as fuel for power plants; (4) in cement production; (5) in brick and tile manufacturing.

(1) Alum Production

The first alum works at Degerhamn using shale as raw material was established in 1723. Alum was formerly a product rather in good demand throughout the world, and brought fine prices. The alum works at Degerhamn employed not less than 322 persons in 1807 for the extraction, burning and washing of the shale, and firing 20 boilers for the concentration of the liquid. The modern chemical industry killed this old-time production, of which the only traces remaining are enormous heaps of shale ashes.

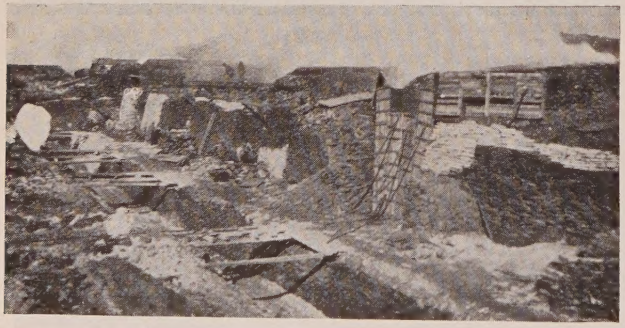
(2) Lime Burning

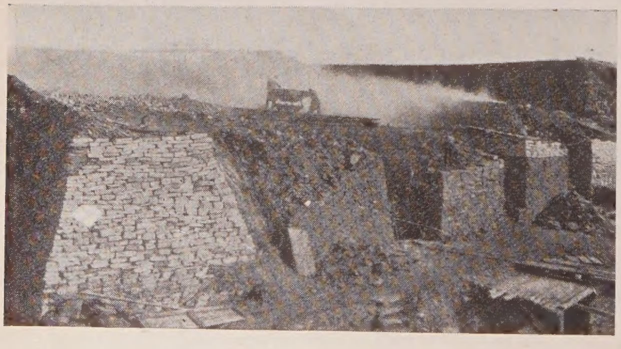
The use of oil-shale for burning lime is of most ancient date. In the beginning it is probable that the method was used by farmers for producing the lime needed for agriculture. A regular industrial lime production did not come into existence till much later. Burning lime has always taken place, and is still performed in piles and in clamps as shown in Fig. 3. As the composition of the shale and its calorimetric value varies greatly, the result has been very poor in the old style kilns. The shale contains, according to an inclusive sample of the entire deposits at Degerhamn, 81.0% ash, and produced 4.33 % oil at dry distillation. In the same sample were present C., 11.38% and S., 9.62%.

A recently carried out test has shown that the fuel value of the shale deposits at present quarried for fuel purposes amounts to from 1400–1750 effective calories. It will be seen that a fuel with so low a heating value can only be used on the condition that great quantities are required and that the conveyance of the shale and the ashes can be performed in the most economical manner. All this has been taken into consideration at Degerhamn from the very beginning.

The lime was formerly burnt in piles, placed on the slopes close by the quarry, and generally in such a way that the slate ashes could be dumped from the height without requiring further transport. Piles of that kind had a shape that was reminiscent of charcoal piles, and were often from 4 to 8 meters square. They were erected on a bottom layer of broken up shale about 1-metre in thickness; on top of this was a limestone layer some 50 to 75 cm. thick, which in turn was covered by shale. The pile was in this way built up of alternating shale and limestone layers to a height of from 3 to 4 meters. The pile was covered with a layer of shale ashes as protection against the wind and too rapid combustion. The pile was put alight in a hollow underneath the base, whence the fire spread slowly through the layers and in so doing converted the limestone into lime. As soon as the fire had burnt out —which took from 1 to 2 weeks—the pile was pulled down and the burnt lime sorted out, the ashes being dumped aside as refuse. This primitive method of burning lime has been in use in Sweden for hundreds of years, in all places where combustible shale was available. It has in part been carried on as a side issue by farmers, especially during the winter season when work on the farm was slack. The piles were then set up in the early part of the winter, and were set afire in the spring or summer following.

The use of built up stationary kilns or furnaces, which for one thing made the combustion less dependent on the weather, represented a great advance. Burning lime in the above described piles can only be done effectively when the pile is protected against storm and rain, and it may often occur that the weather conditions prevent a uniform distribution of the heat, with the result that the limestone remains unburnt and the whole work is wasted. In the simple kilns, the so-called clamps, the chances of obtaining a good result are more favorable. These kilns are built up of stone or slate slabs, without mortar, being circular or elliptical in shape as a sort of shaft-kiln and have an opening of a few meters extent, the so-called breast. These kilns were also erected close to the quarry, often being placed in a row on a terrace system, as shown in Fig. 4. Limestone and shale being quarried in the neighborhood are alternately dumped into the kiln in about equal proportions, filling it to the top with alternate layers of shale and limestone. As soon as the kiln is filled the mass is set on fire at the bottom layer causing the whole charge to burn. About a week later the kiln may be opened at the breast and emptied. The lime is sorted out and loaded on trucks, and the ashes are dumped down the slope. The illustrations show such rows of clamps: (Fig. 3) during charging; (Figs.





Figs. 5 and 6—A Range of Clamps, Burning

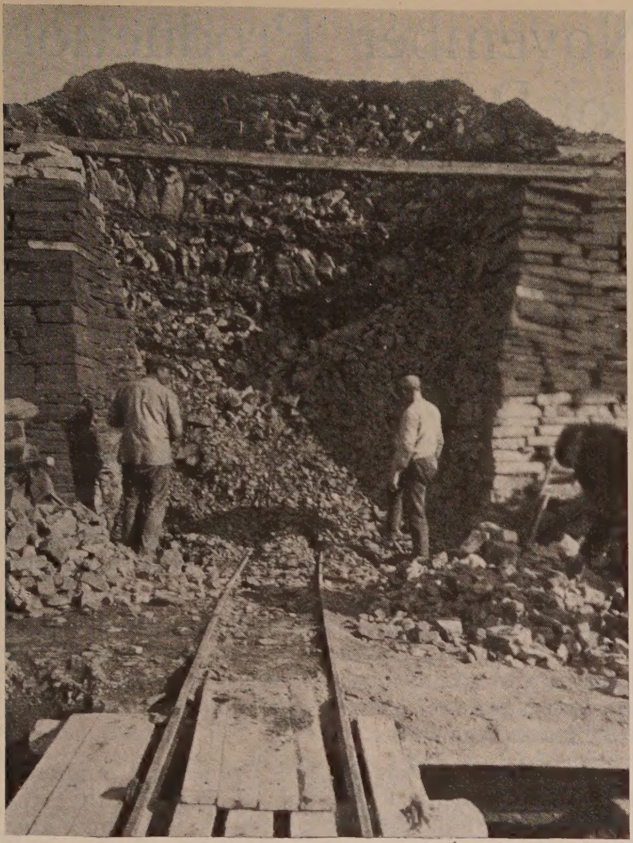


Fig. 7—A Clamp Being Emptied
Fig. 8—Ash Heaps Beneath the Piles and Clamps

5 and 6) during burning; and (Fig. 7) while being emptied after burning.

Only hand work is used at this rather primitive method, and about 4 weeks are required for producing some 200 tons of lime. Of this time one third is consumed in charging, one third in burning, and one third for emptying. Thus a great number of clamps would be required for attaining a large production. Even so a great many lime producers in Sweden use exclusively the described method.

The Degerhamn works abandoned this method, however, in view of its proved inabilities for up-to-date production and its low economy. After trials extending over many years the system of burning lime in shaft kilns was adopted, using shale as fuel exclusively. These shaft kilns became available when rotating kilns were installed for the cement production. The lime-burning is now carried on at a considerable magnitude, with the use of mechanical transporters and automatic devices for operating the kiln.

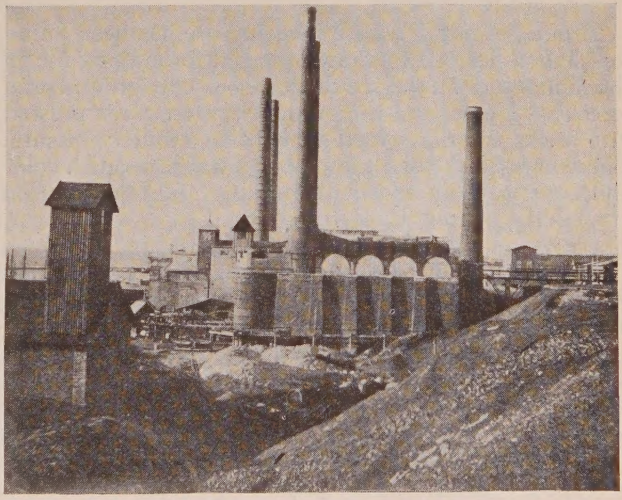
The shale is broken up in a large crusher, and is stored in a spacious storage-bin, whence it is discharged and conveyed to the shaft kilns by means of trucks on a viaduct. The kilns are charged in the usual way with alternate layers of shale and limestone. The gases generated at the burning, which have an exceedingly unpleasant odor and, in case of clamps, foul the air in the vicinity, are collected in a duct above the kilns and pass out through the stacks (Fig. 9). The kilns are emptied in the same manner as practiced at all shaft kilns and the lime is picked out of the ashes. The ashes are loaded into trucks and conveyed to the ash pile by means of an aerial conveyer, shown in Fig. 10. The productive capacity of a shaft kiln is from 8 to 10 tons of lime in 24 hours. The operations are naturally quite independent of weather conditions, etc. and are continuous day and night.

(3) Shale as Fuel for Steam Boilers

The shale was used as boiler fuel in the power plant during the war years, when the price of coal rose to fantastic figures. About 120–150 tons of shale were consumed daily for this purpose. The boiler furnaces were rebuilt to make this feasible and fitted with a special grate. In addition it became necessary to provide special devices for removal of the ashes. These arrangements turned out particularly successful, and after the initial period the plant could be kept going without trouble despite the low heating value of the shale. On the price of coal again resuming a comparatively normal figure, however, the shale firing did not prove economical, and the boiler plant was once more adapted for coal firing.

(4) Use of Shale in the Production of Cement

The first cement works at Degerhamn was put up by the Öland Cement Aktiebolag, being at that time (1888) equipped with shaft kilns, like all contemporary cement works. Twelve kilns were installed. The raw material was a limestone of excellent quality, found in a layer 4–5 meters thick on top of the shale. Clay is not available in Öland, and had to be taken



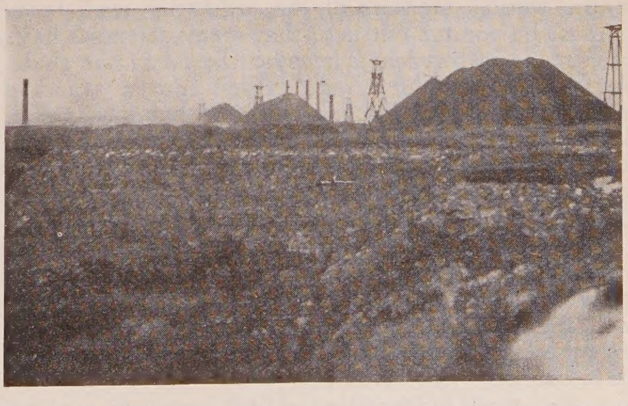


Fig. 9—Plant of Shaft Kilns for Lime Burning with Shale with the Cement Plant Shown in the Background
Fig. 10—Heaps of Shale Ash with Air Conveyor

from the mainland, where there are clay pits of great magnitude. With these raw materials a splendid cement was produced. After 20 years of production on the shaft furnace system, these were replaced by two rotary kilns, working on the dry method. The latter are still in use.

This change of production method caused the management to look for a substitute for the clay, as it was not a prime condition of the new method to have the mass plastic. After attempting for some time without success to use crude fuel shale, as well as sandstone and slate deposited underneath the fuel shale, it was found that the shale-ash was an ideal substitute for clay in the production of the cement. This was particularly the case with the ash in the immense heaps of refuse from the time alum was produced at the site. This material was very soon used exclusively instead of clay, and of late years the ash from the lime burning has also been taken into use for the cement manufacturing without causing any inconvenience. One advantage of using this ash is that it is dry when it comes from the lime furnaces, which does away with the expensive drying process, and consequently lowers the production costs considerably. The chemical composition of the ash is the following:

SiO^2	53.80
Al^2O^3 Fe^2O^3	34.45
CaO	3.00
MgO	1.99
SO^3	3.56
H^2O	2.48

Especially worth noting is the low percentage of SO^3, unusually so, when compared with the ash of German and British shale, which, just because of their high SO^3 percentage, are quite unfit for cement manufacture.

(5) Tile Manufacturing From Shale Ashes

In most recent years still another use has been found for shale-ashes, viz., as raw material for making tile on the lime-sand method. Shale ashes are ground and mixed with lime, and the product is afterwards pressed into bricks and tiles which are hardened under pressure. These hard bricks and tiles are of a warm, reddish color and constitute an excellent building and construction ary building brick made from clay.

These hard bricks and tiles are of a warm, reddish color and constitute an excellent building and construction material. It is indeed a formidable competitor of ordinary building brick made from clay.

It will be seen from the foregoing that a great many uses have been found for shale in Sweden, and it is undoubtedly safe to say that it will capture a still wider sphere of utility even though it take some time. The interest in shale is fluctuating, i.e., it receives attention in proportion to the abundance or scarcity in the world's markets of the ordinarily used fuels. It must be pointed out here that many attempts have been made in Sweden to recover the oil in the shale. So far they have not materialized into a practical method—although the lines for one have been laid down—for one thing because the oil percentage of Swedish shale is very low. The present prices of coal and mineral oil also being comparatively low, it would therefore be impossible now to interest the proper parties in shale-oil production.

None the less, the Swedish shale industry has evolved manifold methods for using this low value fuel, and must be conceded to have been highly successful in this sphere. By discovering ways and means for a country with insufficient resources of fossil fuel to make herself independent of coal importion to some extent much good work of national economic importance has been accomplished.

November Production of Portland Cement Exceeds Demand

Production of portland cement in November was 12,603,000 bbls., an increase of 11% over November 1922, according to the latest bulletin issued by the United States Geological Survey. For the eleven months ending November 30, production was nearly 127,000,000 bbls. or 12% more than ever before for a similar period.

A seasonal falling off is shown in shipments for the month, the movement from the mills being 10,251,000 bbls. Shipments for the eleven months' period exceeded 129,000,000 bbls., an increase of more than 17,000,000 over the corresponding period of 1922, the best previous record.

Notwithstanding the remarkable demand experienced this year, production has been relatively greater and stocks of finished cement in manufacturers' hands on November 30 were 6,964,000 bbls. an increase of 30% over last year.

The Bureau of Foreign and Domestic Commerce, of the Department of Commerce, reports that the imports of hydraulic cement in October, 1923, amounted to 172,051 bbls., valued at $295,378. The total imports in 1922 amounted to 323,823 bbls., valued at $628,846. The imports in October were from Sweden, 38,652 bbls.; Norway, 36,638 bbls.; Canada, Quebec and Ontario Provinces, 30,502 bbls.; British Columbia and Yukon, 3,020 bbls.; Maritime Provinces, 18 bbls.; Belgium, 29,501 bbls.; Denmark, 19,314 bbls.; England, 11,683 bbls.; the Netherlands, 1,996 bbls.; other countries, 727 bbls. The imports were received in the following districts; North Carolina, 36,352 bbls.; Hawaii, 25,063 bbls.; Porto Rico, 21,310 bbls.; Oregon, 18,963 bbls.; Buffalo, 17,396 bbls.; Los Angeles, 16,419 bbls.; New York, 13,892 bbls.; Washington, 9,097 bbls.; St. Lawrence, 5,582 bbls.; Vermont, 5,272 bbls.; Rochester, 2,097 bbls.; other districts, 608 bbls.

The exports of hydraulic cement in October, 1923, were 74,302 bbls., valued at $207,657, of which was sent to Cuba, 21,916 bbls.; to the other West Indies, 7,933 bbls.; South America, 20,720 bbls.; Mexico, 10,662 bbls.; Central America, 8,851 bbls.; Canada, 2,383 bbls.; and to other countries, 1,837 bbls.

The statistics of imports and exports of hydraulic cement in November, 1923 are not available.

IMPORTS AND EXPORTS OF HYDRAULIC CEMENT, BY MONTHS, IN 1922 AND 1923, IN BARRELS(*a*)

Month	Imports		Exports	
	1922	1923	1922	1923
January	17,039	71,686	70,725	73,169
February	5,157	20,529	82,421	88,624
March	1,597	66,521	103,556	98,861
April	10,855	76,416	75,412	85,662
May	2,524	88,480	100,068	103,634
June	14,198	111,559	96,263	77,203
July	957	286,106	119,491	82,774
August	56,757	323,948	105,156	73,201
September	(*c*)42,641	215,785	78,615	77,121
October	(*d*)65,228	172,051	80,402	74,302
November	61,010	(*b*)	108,798	(*b*)
December	45,860	....	106,938	....
	323,823	....	1,127,845	....

(*a*)Compiled from records of the Bureau of Foreign and Domestic Commerce. (*b*)Imports and exports in November, 1923 not available. (*c*)Covers period Sept. 1-21. Imports Sept. 22-30 included with Oct. (*d*)Includes imports period Sept. 22-30

Lime In 1922

By G. F. Loughlin and A. T. Coons

Abstracted from Mineral Resources of the United States, 1922—Part II. Published December 1, 1923.

General Conditions

The industrial reaction from the severe business depression of 1921 was reflected in an increase of 44% in the quantity of lime produced in 1922. The output for 1922 was 2% more than that for 1920, a year of industrial activity in the building and chemical trade. Of the 42 States and Territories that produced lime in 1922, 39 showed an increase in output. This showing is in marked contrast with that for 1921, when the output of only 8 States increased. The 3 States that showed decreases in 1922 are all small producers of lime and serve markets that are largely influenced by local demand. Ten more plants reported operations in 1922 than in 1921. New commercial plants were put into operation during the year, and old plants increased their output, although not to their full capacity. There was considerable activity among the small producers who burn lime for themselves or for local consumption, although in Pennsylvania, where most of these small kilns are operated, the number of operations decreased by 6.

Production

Lime Sold in the United States in 1920-1922

Year	Short tons	Value.(*a*)		Number of plants in operation
		Total	Average	
1920	3,570,141	$37,543,840	$10.52	515
1921	2,532,153	24,895,370	9.83	520
1922	3,639,617	33,255,039	9.14	530
Percentage of increase or decrease in 1922	+44	+34	—7	+2

(*a*) The value given represents the value of bulk lime f. o. b. at point of shipment and does not include cost of barrel or package.

Pennsylvania, which has long held rank as the principal state in the production of lime, was outranked by Ohio in 1922. Over 70% of the lime produced in Ohio is used for construction, and most of the remainder for the manufacture of chemicals, and both these uses showed large increases in 1922. At present about half of the lime manufactured in Pennsylvania finds use in chemicals, about one-third in construction work, and the remainder in agriculture. Formerly a larger percentage was used for liming the land, and the gradual decrease in the output for this use has been the chief factor in the reduced rank of the State. Also a large part of the chemical lime sold in Pennsylvania is used for metallurgical purposes connected with the manufacture of iron and steel, an industry which did not regain full activity in 1922. The rise of West Virginia from sixth place in 1921 to third place in 1922 is also noteworthy. It was due to the increased manufacture of chemical lime.

The high price and scarcity of coal were obstacles to economical operation in 1922, as in 1921. The use of wood to help conserve coal was noted by the manufacturers. Labor was more plentiful, but cars for transportation of the product were not always available. Prices fluctuated greatly throughout the year but showed a decided downward trend, and the average value per ton for the total United States was 7% less than in 1921.

Uses

Lime Sold in the United States in 1921 and 1922, by Uses

Use	Percentage of total quantity	Short tons	Value	
			Total	Average
1921				
Building	49.0	1,239,486	$13,258,443	$10.70
Agriculture	11.2	284,722	2,237,510	7.86
Chemical:				
Paper mills	9.3	235,855	2,207,938	9.36
Glass works	1.7	43,851	367,796	8.39
Sugar factories	.5	12,225	161,931	13.25
Tanneries	1.9	47,841	481,372	10.06
Metallurgy	6.5	164,245	1,232,748	7.51
Other uses	18.0	456,087	4,372,991	9.59
Total chemical	37.9	960,104	8,824,776	9.19
Dealers	1.9	47,841	574,641	12.01
	100.0	2,532,153	24,895,370	9.83
Hydrated lime (included in totals)	....	792,970	7,421,637	9.36
1922				
Building	50.7	1,845,208	18,463,825	10.01
Agricultural	7.5	272,726	2,005,082	7.35
Chemical:				
Paper mills	8.5	310,229	2,683,487	8.65
Glass works	1.7	62,187	463,628	7.46
Sugar factories	.5	16,393	197,878	12.09
Tanneries	1.2	42,978	420,148	9.78
Metallurgy	5.5	200,799	1,458,553	7.26
Other uses	22.9	834,279	6,986,366	8.37
Total chemical	40.3	1,466,865	12,210,060	8.32
Dealers	1.5	54,818	576,072	10.51
	100.0	3,639,617	33,255,039	9.14
Hydrated lime (included in totals)	....	1,106,063	9,868,980	8.92
Percentage of increase or decrease of hydrated lime in 1922	....	+39	+33	+5

Building Lime

The output of lime for construction work, which decreased 5% in quantity in 1921, increased 49% in 1922. The revival in constructional activity in the last part of 1921, which kept building lime more nearly normal than any other lime product during that year, continued through 1922. Whether the curtailment of construction early in 1923 and the rise in prices of labor and of some building materials will react on the lime industry in 1923 is uncertain. In 1922 all the prominent states showed increases in output of building lime, ranging from 30 to 70%. Ohio produced 30% of the building lime manufactured in 1922, and 95% of Ohio's product was sold as hydrated lime. Pennsylvania produced 13% of the building lime, and Wisconsin a little less than 10%.

Chemical Lime

The output of lime sold for chemical uses increased nearly 53% in 1922, after a decrease of 48% in 1921. The increase was shown by lime for all the principal chemical uses except tanneries. Dead-burned dolomite made the most remarkable increase—224%. Furnaces and smelters that use this product resumed operations during 1922, and all the states supplying these plants showed marked increase in sales. Dead-burned dolomite is produced at Ensley, Ala.; Natural Bridge, N. Y.; Peebles (Kenova, W. Va.), Maple Grove and Beltsville, Ohio; Bainbridge, Plymouth Meeting, and Saginaw, Pa.; and Millville, W. Va. Furnaces and smelters also buy the raw dolomite for use as a refractory material.

Agricultural Lime

The total sales of lime for agriculture decreased 4% in quantity in 1922. Ohio was the only important state to show an increase. Pennsylvania, the principal producing state, decreased 10% and Maryland, Virginia, and West Virginia also decreased. The decrease of this product is ascribed to the farmers' inability to buy lime. Ground limestone, which for several years increased in output as burned lime decreased, has since 1919 also decreased. In 1922 the production of ground limestone was 9% less than in 1921. Sales of calcareous marl and oyster-shell lime for agricultural purposes, increased in quantity 13 and 29%, respectively, in 1922. It will be noted that while the total sales of lime from limestone decreased 4%, sales of hydrated lime for this purpose increased 5%.

The means by which the effective lime content of the different forms of land lime is calculated was discussed in the report for 1921. In 1922 producers of pulverized limestone were asked to report the grading of the material sold by them as a more effective means of determining this factor, but the replies were so indefinite that it was impossible to obtain any more complete information.

All the calcareous marl sold in the United States in 1922 was used for liming the soil. Virginia produced 28,971 short tons, valued at $57,887. New deposits for the production of this material were opened in California in 1922, and the output for the State was 16,231 short tons, valued at $75,109. The other producing states were Arkansas (chalk), Maryland, New York, North Carolina, Ohio, Pennsylvania, West Virginia, and Wisconsin.

The burning of lime from oyster shells is an industry of minor importance in Maryland, Virginia, Pennsylvania, and New Jersey. The production in Virginia in 1922 was 18,561 short tons, valued at $163,566, and in Maryland 9,878 short tons, valued at $64,945. This lime is sold almost entirely for agriculture, but some of it is also sold to chemical works.

Hydrated Lime

In presenting the output of hydrated lime it is the intention of the United States Geological Survey to include only the product made in hydrating machines and to omit hand-slacked lime. There were nine more plants reported as producing hydrated lime in 1922 than in 1921. Hydrated lime increased 39% in quantity and 33% in value in 1922 and for the first time showed a total production of over 1,000,000 tons.

Hydrated Lime Sold in the United States, 1920-1922

Year	Short tons	Value		Number of plants in operation
		Total	Average	
1920	853,116	$9,287,562	$10.89	98
1921	792,970	7,421,637	9.36	105
1922	1,106,063	9,868,980	8.92	114

Hydrated Lime Sold in the United States in 1921 and 1922, by Uses

Use	1921		1922	
	Short tons	Value	Short tons	Value
Building	539,550	$4,996,718	800,353	$7,135,264
Agriculture	142,582	1,297,192	150,423	1,254,894
Chemical:				
Paper mills	4,840	48,270	10,305	101,945
Sugar factories	4,633	38,628	6,337	59,943
Tanneries	14,872	153,336	16,736	167,318
Glass factories	1,299	12,934	1,833	19,881
Metallurgy	2,453	21,921	1,930	19,085
Other uses	69,612	718,285	101,510	956,334
	97,709	993,374	138,651	1,324,506
Total chemical	13,129	134,353	16,636	154,316
Dealers	792,970	7,421,637	1,106,063	9,868,980

In regard to kilns, fuel and capacity of plants, it may be noted that the total reported capacity of 19,429 tons a day, based on a full 300-day running time, is 60% more than the actual production.

Consumption

Practically all the States showed an increase in per capita consumption in 1922, indicating the general activity of construction and chemical enterprises throughout the country.

The lime produced in Ohio is more widely shipped than that from any other state; that of Missouri and Pennsylvania has the next widest distribution.

Exports and Imports[1]

Lime Exported from the United States, 1920-1922

Year	Short tons	Value	
		Total	Average
1920	5,921	$128,296	$21.67
1921	5,192	109,769	21.14
1922	8,289	116,649	14.07

Lime Imported and Entered for Consumption in the United States, 1920-1922(a)

Year	Short tons	Value	
		Total	Average
1920	22,688	$392,137	$17.28
1921	10,811	234,798	21.72
1922	14,112	290,845	20.61

(a) Most of the lime imported into the United States comes from Canada

[1] Statistics of exports and imports compiled by J. A. Dorsey, of the United States Geological Survey, from records of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

Canadian Lime Production

Revised figures issued by the Dominion Bureau of Statistics, on the production of lime in Canada, show that the total value of lime produced in Canada in 1922 was $3,165,005, an increase of 12% over the 1921 production, which amounted to $2,781,197. The total production comprised 7,698,028 bushels of quicklime, valued at $2,622,726, and 44,623 tons of hydrated lime, valued at $542,279. About 29% more quicklime was sold in 1922 than in the preceding year, but the value of these sales was only 12% higher. Likewise, the production of hydrated lime increased 39% in quantity and only 24% in value.

The average price received for a bushel of quicklime in 1922 was 34 c. as compared with 40 c. in 1921; hydrated lime averaged $12.15 per ton in 1922, as against $13.65 in 1921.

During 1922, the production of stone from quarries in Canada had a total value of $5,989,864, a decrease of 10% from 1921, when the total value was $6,343,696. Increased production was quite general throughout the items listed, but this was more than offset by the decrease in the production of crushed limestone.—*Canadian Engineer.*

Norway Cement Unit Is Shut Down

One of the larger Norwegian cement units stopped operations December 1, due to overstocks at plant and lack of unfilled orders. One reason given for the falling off of business was the reduced inquiry from United States buyers, and another the loss of tonnage destined for Japan because of lower offerings made by German and Belgian factories. (Consul General Alban G. Snyder, Christiania.)—*Commerce Reports.*

Slurry Fineness Chart

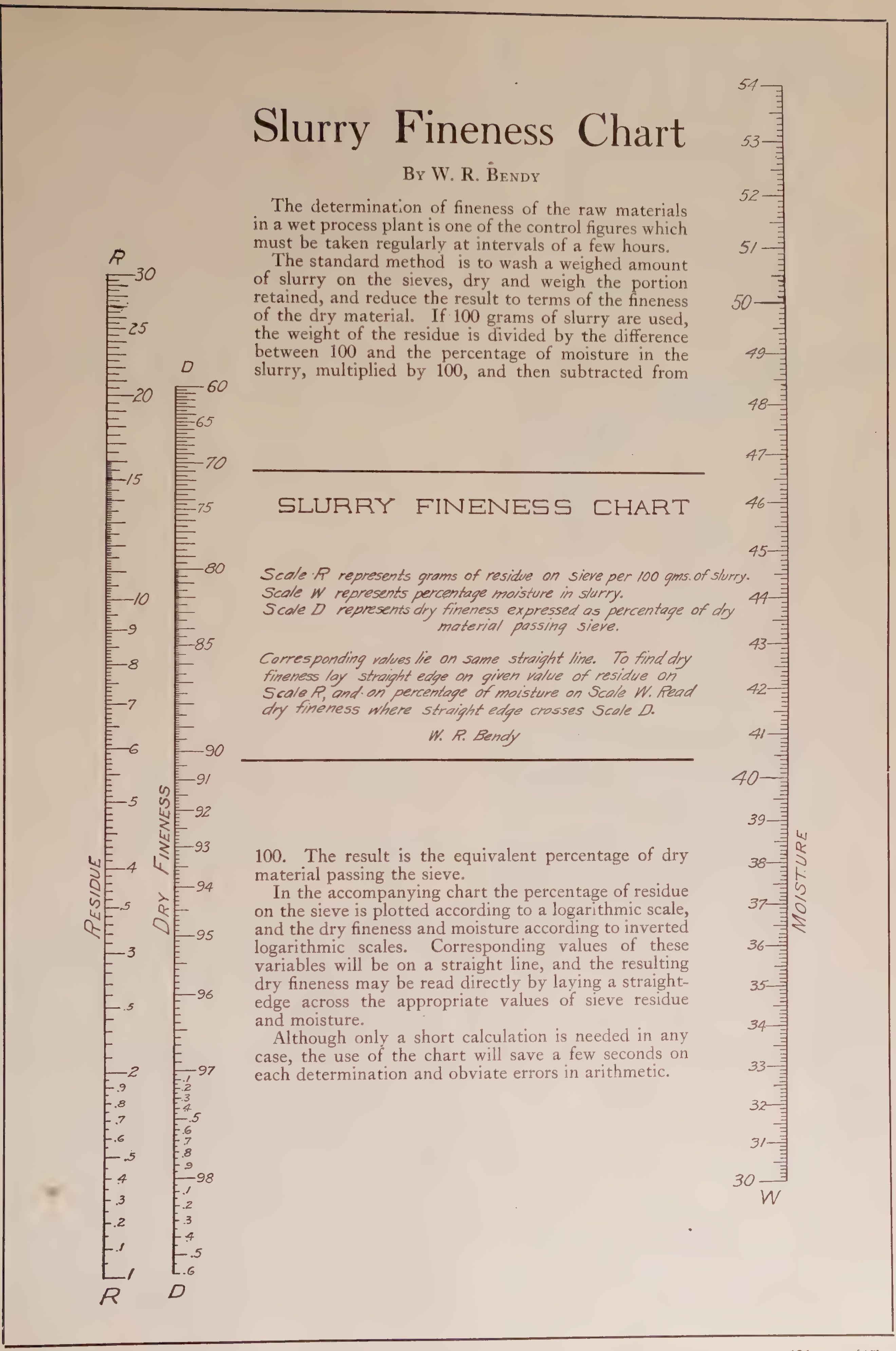
By W. R. Bendy

The determination of fineness of the raw materials in a wet process plant is one of the control figures which must be taken regularly at intervals of a few hours.

The standard method is to wash a weighed amount of slurry on the sieves, dry and weigh the portion retained, and reduce the result to terms of the fineness of the dry material. If 100 grams of slurry are used, the weight of the residue is divided by the difference between 100 and the percentage of moisture in the slurry, multiplied by 100, and then subtracted from 100. The result is the equivalent percentage of dry material passing the sieve.

In the accompanying chart the percentage of residue on the sieve is plotted according to a logarithmic scale, and the dry fineness and moisture according to inverted logarithmic scales. Corresponding values of these variables will be on a straight line, and the resulting dry fineness may be read directly by laying a straightedge across the appropriate values of sieve residue and moisture.

Although only a short calculation is needed in any case, the use of the chart will save a few seconds on each determination and obviate errors in arithmetic.



SLURRY FINENESS CHART

Scale R represents grams of residue on sieve per 100 gms. of slurry.
Scale W represents percentage moisture in slurry.
Scale D represents dry fineness expressed as percentage of dry material passing sieve.

Corresponding values lie on same straight line. To find dry fineness lay straight edge on given value of residue on Scale R, and on percentage of moisture on Scale W. Read dry fineness where straight edge crosses Scale D.

W. R. Bendy

Reduction in Tariff on Magnesite Opposed

By Irwin D. Foos

Indefinite postponement of further consideration by the Tariff Commission to applications of Austrian producers of magnesite for a reduction of 50% in the tariff on American importations was requested in a petition filed December 5 by the Austro-American Magnesite Co., of Vienna, one of the parties asking for a lowering of the duties, and reported to be the largest producer of deadburned magnesite in Austria. The Commission previously had postponed a hearing in the case from October 15 to December 5 at the request of the same company.

Although taking the petition for further delay under advisement, domestic manufacturers and consumers of magnesite present at the hearing on December 5 were instructed by the Commission to proceed with the introduction of their testimony in opposition to the reduction in duties proposed by the foreign producers, among which are the Veitscher Magnesitewerke A. G., Austro-American Magnesite Co., Steirische Magnesit Industrie A. G., and Magnesitwerke Eichberg Aue Gesellschaft, the Austrian companies, and the General Magnesite Co., Ltd., of Bratislava, Czechoslovakia, a subsidiary of the General Refractories Co., of Philadelphia. None of the foreign companies was represented at the hearing.

Nelson Franklin, representing the Northwest Magnesite Co. of Chewelah, Wash., the principal domestic producer of deadburned magnesite, and Stanley H. Barrows, president of the Sierra Magnesite Co., of Porterville, Calif., the largest producer of caustic magnesite in the United States, protested against postponement of the proceeding and testified in opposition to a reduction in the present tariff duties which are $\frac{5}{16}$¢ per pound on crude magnesite; $\frac{5}{8}$¢ per pound on caustic calcined magnesite; and $\frac{23}{40}$¢ per pound on deadburned and grain magnesite, not suitable for manufacture into oxychloride cement. George W. Selby, representing the Magnesite Cement Building Products Association, testified that the duties on crude and caustic, the only products in which the members of the organization are interested, are excessive.

Mr. Franklin testified that there is no reason for a decrease in duties, asserting from his own knowledge that the Austro-American Magnesite Co. now regarded its action requesting the reduction as premature and regretted that it had joined in the application filed with the Commission last April. Mr. Franklin introduced in the record detailed figures of the Washington plant's cost of production and made the suggestion that the Commission would find in its investigation that an increase rather than a decrease in duties was justified.

Mr. Selby testified that the magnesite cement products producers have been compelled by excessive duties to buy lower grades of California caustic calcined magnesite. He asserted that it was "incongruous that the consumers should be penalized for the excessive profits of the mining companies." The consumers are entitled to an open market, Mr. Selby contended. When foreign supplies were cut off, he said, domestic producers consistently raised prices. Mr. Selby also stated that the magnesite cement products manufacturers were entitled to consideration because of the relatively greater capital investment in that industry than in the mining of the domestic magnesite.

The Potash Industry in America

That a survey of the progress of the potash industry in America since the World War shows that the United States has finally emerged as a potash producing country is pointed out by the American Chemical Society, 19 East 24th St., New York city. An American investigation of French potash activity in Alsace shows, the statement says, marked advances both in business management and technical skill. The United States, it is stated, is producing potash superior to that of other nations and at a cost far lower than during the war. Americans are now buying up their own potash production before purchasing abroad. It has been pointed out that a study of the figures available show that the German potash monopoly which existed since about 1860 no longer exists and as far as quantity is concerned, if Germany were again shut off from the world the world would not necessarily be lacking its full quota of potash.

That the manufacture of cement in foreign countries will always be an important factor in the prices of cement in the United States is the opinion of H. Struckmann, president of the International Cement Corp., who recently returned from Europe where he went as representative of American portland cement manufacturers to invite a delegation of British manufacturers to attend the annual meeting of the Portland Cement Association held in New York last November.

Summarizing cement conditions in the European market, Mr. Struckmann stated that although European manufacturers have the advantage of much cheaper labor and fuel than cement producers in this country, domestic prices in Europe are somewhat in excess of the prices realized by the various mills operated by the International Cement Corp. in this country.

It is further cited that taking into consideration the fact that half a ton of coal is consumed in the production of one ton of cement and also that producers in the United States are paying in wages almost double the sum paid by European manufacturers, this country may justly be proud of its cement industry.

The plant of the Olympic Portland Cement Co. at Bellingham, Wash., produced 570,000 bbls. of cement valued at about $1,500,000, in 1923. The year's shipments totaled 530,000 bbls., the bulk of it being taken by buyers in the home state. A few thousand barrels were shipped to Honolulu. A big percentage of the Washington shipments was used in road making.

The Bellingham plant has been running steadily throughout 1923, operating at full blast practically all the year. On the average it has had 140 men on the payroll, including quarrymen and clay pit workers.

The company plans to operate at full capacity throughout 1924. It closed for annual repairs on December 22. These will require about two weeks.

J. E. Zahn, general manager of the United States Portland Cement Co., Denver, Colo., has been elected a director of the Victor Highway Association. Mr. Zahn is also a member of the committee whose purpose it is to endeavor to have Mayor Stapleton of Denver, appoint a municipal industrial commissioner to give expert advice to small manufacturers in making and marketing their goods.

A waste heat boiler plant is being constructed at the cement plant of the Lehigh Portland Cement Co., near Mason City, Ia. Excavation and foundation work are practically completed.

The structural steel frame work for the building is being erected by the Burrell Engineering and Construction Co., Chicago, Ill., and the waste heat boilers and machinery will be installed by the Edge Moore Iron Co., as soon as construction in progress will permit. It is expected the waste heat boilers will furnish enough power to run a large part of the machinery in the entire plant.

A new supply well, also a part of the Lehigh company's building program, is being drilled. A 20-in. pipe is being extended to considerable depth into the limestone rock and it is the intention of the drillers to complete the well with a 12-in. pipe.

The stone plant at Rockport, Mich., closed about the middle of December as no more boats were expected and the storage which has a capacity of about 42,000 tons has been filled. The storage structure has just been completed and is equipped with two large conveyor belts, one of which carries the crushed stone from the mill to the storage pile. The other belt is underneath in a concrete tunnel and carries the stone to the docks when boats are to be loaded.

A large crew will be kept at the plant for repairing and stripping operations.

It is reported that the plant has completed the most successful season since it was built, having loaded an average of five boats a week and employed a crew of about 350 men. Many improvements will be made during the winter and a still better season is expected in 1924.

The Lehigh Portland Cement Company's plant at Mason City, Ia., which closed for repairs Dec. 15, opened again on Dec. 26, and the plant will run continuously day and night as it has in the past.

In past years it has been the custom to wait until after the holidays before making the annual shut down, but as it often happened that stormy and zero weather made repair work difficult, this year the Lehigh officials set the date for making the necessary repairs earlier, thinking that the workmen would be favored with pleasant weather. The repair work has been successfully completed.

A very interesting meeting of a large number of the employes of the Louisville Cement Co., at Milltown, Ky., was held on November 16 at which, according to the *Speedometer*, new service pins were presented to old employes of the company. The men were called together presumably to enjoy a social hour and talk over a first aid course but the real purpose of the meeting was the distribution of the new service pins which are being given to all employes of the company who have been in continuous service for 5 years or longer.

Accompanying each pin given out by Superintendent Lemon, was a letter from W. S. Speed, president of the Louisville Cement Co., thanking the men for their long service and loyalty to the company.

In Mr. Speed's letter, the fact is cited that the Louisville company was organized in January, 1866 and for a period of 57 years has been steadily engaged in the manufacture of cement. A part of the success of the company in maintaining steady operation during this period is attributed to the loyalty of the men in the employ of the company both at its plant and in the office.

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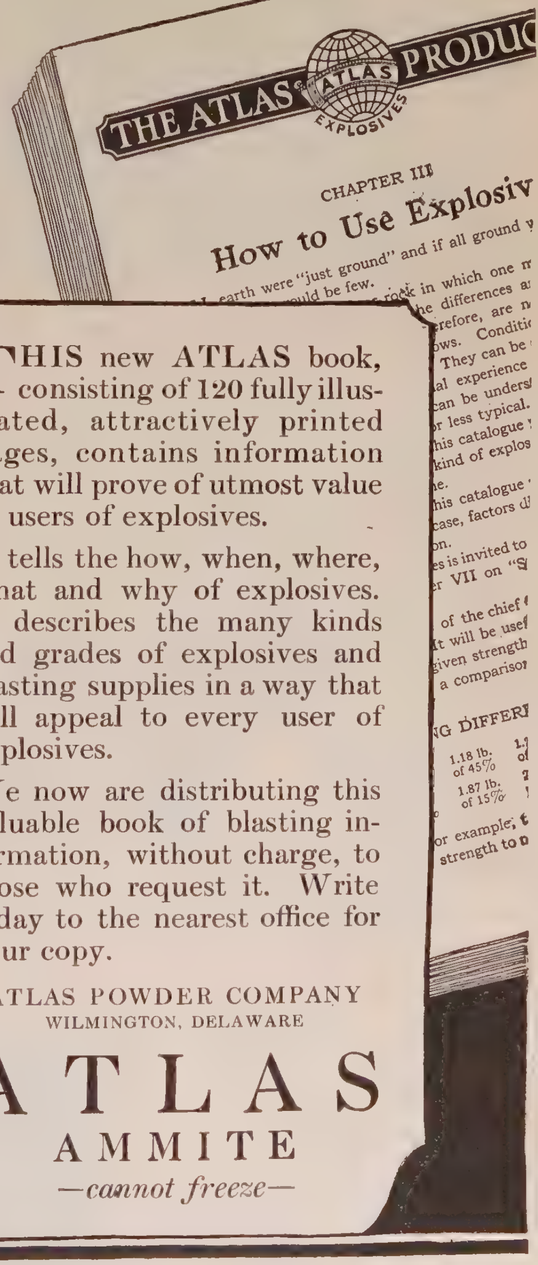

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Dwight P. Robinson & Co. Inc. of New York, has opened an office at Atlanta, Ga., with W. Rawson Collier in charge. Among the company's recent activities in the field are the new wet process cement plant of the Lehigh Portland Cement Co. at Birmingham, Ala.; extension to the steel plant of the American Rolling Mill Co. at Ashland, Ky.; and numerous other industrial plants and extensions.

Macdonald Engineering Co., Chicago, has been awarded the contract for the construction of a cement stock house with a capacity of approximately 100,000 bbls. of cement to be built at Oro Grande, Calif., for the Riverside Portland Cement Co.

J. E. Jellick has been appointed district engineer of The Portland Cement Association in charge of its Los Angeles office, located at 548 South Spring St.

About two years ago, Mr. Jellick joined the staff of the Association, serving as field engineer in Los Angeles county until his recent appointment.

The address of the Philadelphia office of the Portland Cement Association will be 1315 Walnut St. after January 2, 1924. This office has charge of Association work in Delaware and Eastern Pennsylvania.

Cement mills in Illinois are reported as all working regularly.

The complaint of the Coplay Cement Manufacturing Co. against the Philadelphia & Reading railway, declaring rates on limestone shipped from Myerstown to Saylor and Coplay, where the company operates plants, were unjust and discriminatory, has been dismissed by the public service commission.

Ralph C. Bird has been appointed as special sales representative for cement mills by the Chain Belt Co., Milwaukee, Wis., manufacturers of Rex chain, conveyors, transmission machinery and concrete mixers.

Mr. Bird has been connected with the cement industry for approximately 12 years having been associated with the Bradley Pulverizer Co. in the sale of grinding machines for the past 6 years. As special representative for the Chain Belt Co. he succeeds G. O. Curtis now connected with the International Portland Cement Corp., New York.

Through Mr. Bird and other sales representatives the Chain Belt Co. will continue to give special attention to the material handling and power transmission requirements of the cement industry. Special chains have been developed particularly for cement mill use and in addition the company manufactureres various other kinds of equipment used in the cement mill.

Trade Publications

Pulverized Coal for Boilers, *Fuller-Lehigh Equipment for Producing Pulverized Material* and *Fuller News* are the names of 3 new publications by the Fuller-Lehigh Co., Fullerton, Pa., giving the latest information on the preparation and application of pulverized coal. The first mentioned publication, Bulletin 900, is 8 in. x 10½ in. in size, contains 32 pages and is fully illustrated with drawings and photographs showing pulverized coal preparation plant and the various pieces of equipment that go to make up a plant for preparing and using pulverized coal.

Fuller-Lehigh Equipment for Producing Pulverized Material is the title of the pamphlet 4 in. x 9 in. with 24 pages. This pamphlet contains much information about the Fuller-Lehigh mills, crushing rolls, driers and the Fuller-Kinyon system for conveying pulverized material; also information about Fuller pulverized coal burner, Fuller impact unit pulverizer mills, Fuller-Quigley Transport system; feed controller and stock tester gauges. The abstracts of specifications of Fuller Equipment are included as well as tables of capacities of various sizes of Fuller mills when pulverizing different materials.

The *Fuller News* is a folder 8½ in. x 11 in. describing and illustrating the Fuller-Kenyon system for conveying pulverized materials.

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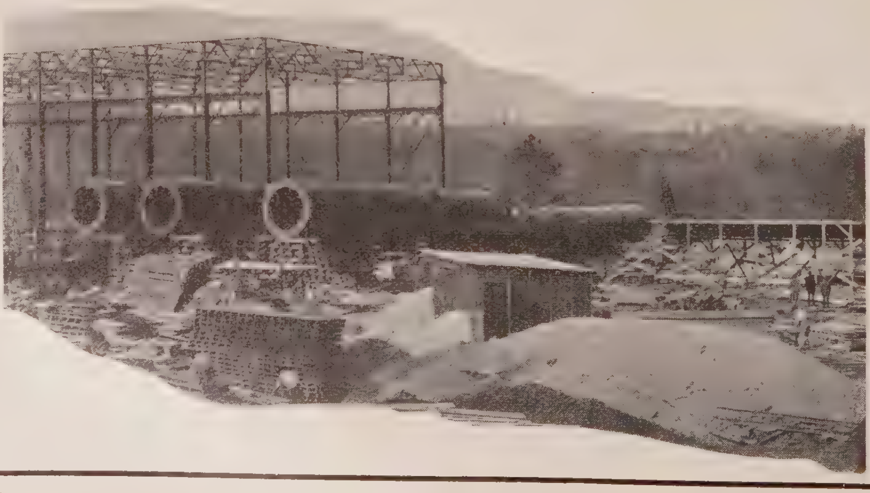
At the Oldest and at the Newest Phoenix Plant

The original plant of the Phoenix Portland Cement Co., at Nazareth, Pa., had—and still has—a complete Vulcan Kiln installation. Here we show three 10′ x 150′ Two-Tire Vulcan Kilns being installed at the same company's new plant at Birmingham, Ala. This plant also has two 7′ x 70′ Vulcan Dryers.



Cement Plant of J. Van Den Heuvel

By J. Goossens
Superintendent, Hemixem-les-Anvers, Belgium

The accompanying illustrations show the arrangement of the cement plant of J. Van den Heuvel at Hemixem, Belgium. This plant employs the wet process, and uses the Mons chalk (lime) and the blue clay or marl from sources close to the factory. As the plant is located on the river Scheldt, which is navigable, both the raw and the finished products are transported by water exclusively.

For this purpose a concrete dock has been built, so as to accommodate steamers up to 800 tons, and lighters up to 1000 tons. To facilitate distribution, the discharge hoppers are located on a monorail, which leads through the factory and permits the discharge of materials at the points where they are required.

As the drawing Fig. 2 shows, all operations are performed in a single hall, 275 ft. long and 81 ft. 6 in. wide, built of steel and reinforced concrete. The chalk (lime) and the clay (marl) are dumped together into a larger receiver, *A*, and reduced to a thick slurry by the addition of about 36% water.

The milky liquid is drawn off by a spout *B* and passes through the space *C* of an elevator into *D*, which in turn is run into five pug mills. When it has been sufficiently worked, the material next is turned into the tanks *F* and *F*. Thereafter it passes through two spouts *G* into the hopper *H* of an elevator which discharges into the hopper of the kiln

The rotary kilns, which have been in successful operation for several years, produce a good quality of well burned clinker.

The coal used for fuel in the kilns, is first pulverized in grinding mills provided with air separators. The fuel is blown in through a fan with the hot air, heated by lost heat from the hot clinker.

The roasted and cooled clinker is either conveyed to the reserve storage or to the grinding department. The grinding takes place in a compound crusher, which leaves a refuse of only 10% on a sieve of 4900 meshes to the square centimeter.

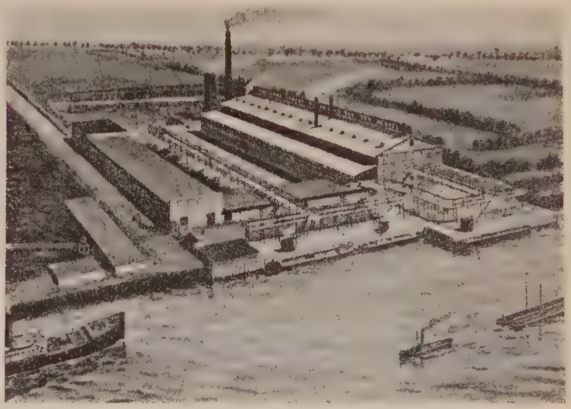


Fig. 1—The Portland Cement Plant of J. Van Den Heuvel, Hemixem, Belgium, from the Water Front

Adjacent to the grinders there is provided storage room in 5 silos, which have inclined floors, and each floor four openings for the sacking of cement.

Both the coal and the clinker grinding machinery are provided with dust collectors which purify the air in the building.

The motive power is produced by means of two condensing engines (injection condensers).

The portland cement produced in this plant has a special reputation for high strength and a reduced weight by volume, on account of its extreme fineness. It is largely in demand by manufacturers of concrete products, cement sidewalks and the like.

The general arrangement of the entire plant is well designed. All available space has been used to advantage and supervision and control of the several phases of operation have been well arranged. The installation of the plant was done by Pfeiffer Freres.

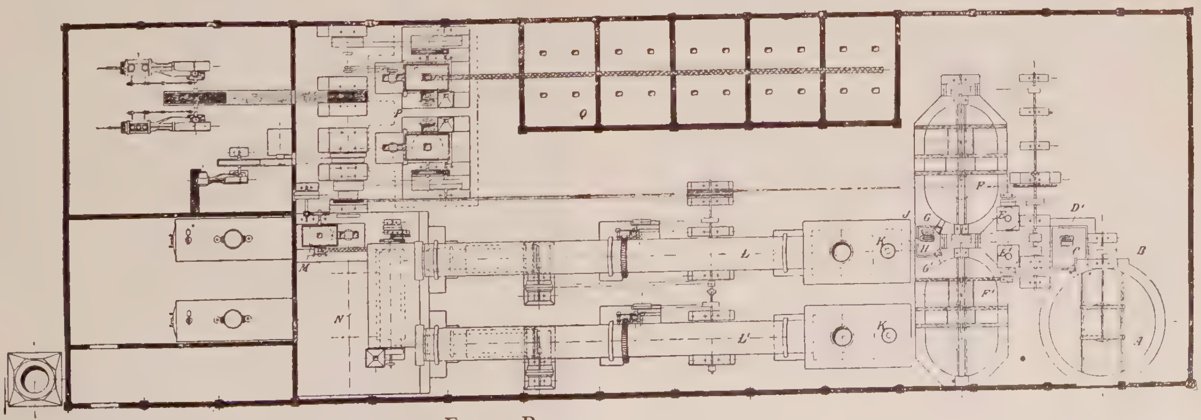


Fig. 2—Plan Showing the Lay-out of the Entire Plant

Blasting Data

By S. R. Russell

[A paper read at the seventh Annual Convention of the National Crushed Stone Association St. Louis January 21-23, 1924.

The subject of this paper is a rather comprehensive one. I was not aware until I received a program of this meeting a few days ago that I was to take part in it and I regret therefore that I have not had time to cover with any degree of fullness the subject assigned to me. A few thoughts on blasting, even if seemingly not associated with the title, may not be amiss.

The very word "data" immediately suggests the word "costs" and I have no doubt that cost figures are interesting and instructive although perhaps also very dry. I'm not going to attempt a long or deatiled discussion of them. They vary so much in actual practice and it is an extremely difficult matter to get full detailed and reliable records. It is a simple matter, as a rule, to arrive at the initial or primary blasting cost of any particular blast; but it is another matter entirely to get full details of this item after the shot has been cleaned up. I know of some operations where quite complete systems are used for arriving at these costs but taken as a whole, quarry operators do not, I find, keep blasting costs in detail. Of course it is easy at the end of the season to weigh the production against the explosives used during that season and say that represents the cost of blasting. It does to a certain extent. It is better, however, I think, to know the cost of each individual shot, taking into consideration the natural conditions surrounding it. The depths, spacing and condition of holes, height of face, amount, kind and strengths of explosives used in each shot should be known. In addition to this the amount of secondary drilling and blasting done before that shot is cleaned up, the shovel delays while cleaning it up, what caused these delays and the time lost and the distribution of the cost of those delays all down the line through the crusher.

In this way it is possible to determine properly the efficiency and economy of certain hole spacings or kinds of dynamite. Every quarry must be studied by itself. Oftentimes it requires considerable experimenting to determine the proper spacing of holes and the right grade of explosives to use in order to arrive at most economical costs. The blasting is of prime importance in any quarry and it affects every subsequent operation, entering as it does at the very conception of the job.

Because certain methods of drilling or a certain type of explosive is used with success in one operation is no assurance that the same methods and types will suit in another quarry even though apparently similar.

I find that primary blasting costs differ widely in quarries producing practically the same character of stone. I know of one operation—a very large one—where the cost in 1923 averaged over 6 tons per pound of explosives used and 80% of the total consumption was 40% strength. This includes primary and secondary blasting and is based on an output of over 6,000,000 tons.

I know of another where the cost was approximately 3 tons of stone per pound of explosive and about 50% of the consumption was 60% dynamite and the other half 40%. Yet both quarries produce stone of very similar nature and it is used for identical purposes.

Both operations are large ones; they are equipped with large crushers, shovels, etc. In the first case the natural conditions are exceptionally favorable, the stone breaks up well, and scarcely any secondary blasting is required. Wider spacing of holes is possible which means greater tonnage per drill foot and greater tonnage per pound of explosive. In the second case the stone tends to come out in larger heavier masses necessitating considerable secondary drilling and blasting. In the first case a railroad type shovel—4-yd. dipper—loads approximatley 2700 tons per shift while in the second case a shovel of the same size loading 1500 to 1800 tons per shift has made a good run. Lower strength explosives at lower cost are used in the first case than in the second. This may illustrate how widely blasting costs can vary and it will be obvious to all of you that the shovel costs and all other costs down the line do likewise.

As a general average I consider 4 tons of stone per pound of explosive for primary blasting very good, if the rock is broken up well enough to keep the secondary cost at a minimum and consistent with the equipment for loading and crushing. Possibly 3 tons would be nearer the average met with in most quarries. Anything over 5 is exceptionally good as in the quarry mentioned above where the explosives used for secondary blasting is less than 1% of the total consumed, yet the total cost is better than 6 tons to the pound.

Still I believe it better policy to increase the initial cost of the blast, either by spacing holes closer, or using more or higher grade dynamite, if the secondary costs of drilling and blasting can be reduced. I know of some quarries where the secondary blasting cost is practically equal to the primary cost. This should not be. A better condition exists where the rock is broken so that the secondary blasting cost is from 25% to 30% of the primary cost. It is not only the cost of the secondary drilling and blasting that counts but it is the delays which this causes to the operation of the shovels that is the big item. Anything which cuts down the efficiency of the shovel should be avoided.

The secret of economical operation in any kind of rock excavation is removing the greatest volume of muck or rock in the least time. This applies whether it is driving a tunnel, deepening a harbor, mining coal or ore or quarrying rock. There is nothing which has a greater bearing on this factor than the blasting—blasting here is taken in its broad meaning to include drilling.

There are basic factors in blasting procedure and basic truths about explosives which greatly affect the cost of producing stone. The power of any explosive to perform work depends upon two facts; first, that a very small volume of the solid explosive forms a very large volume of gas, and second, that this change from a small to a large volume takes place in an exceedingly short interval of time. Explosives differ in the volume of gas formed when detonation takes place and in the time required for the change from the solid to the wholly gaseous state, and the temperature of the explosion. All of these factors—volume, time and temperature—affect the power of the explosive. The greater the volume and higher the temperature and shorter the time, the quicker, stronger and more powerful is the explosive. Therefore in selecting an explosive for a quarry producing crushed stone where the material is hard, better results will be obtained by using a strong, quick, highly shattering explosive of say gelatin type than with a slower one.

One explosive may evolve just as large a volume of gas when detonated as another but at a lower temperature and require more time; if so it will not strike the containing walls as hard and sharp a blow as one which reaches the wholly gaseous state in less time with a higher temperature of combustion.

Some experienced quarrymen think that it is always more economical in the long run to use a high strength explosive in the primary shot. There is a lot of good sense in this belief, too, especially in quarries where the harder rocks, such as trap, granites and hard limestones are produced. In most quarries of this kind more trouble is caused by failure to get good initial fragmentation than otherwise. In some hard rock operations the cost per foot of drilling is extremely high. I know of some where 4 to 5 feet per day is the average for a well drill. In a case like this it pays to use a high strength explosive because often it is possible to set the holes at a wider spacing thus reducing the drilling cost per ton of rock and compensating therefor by using a high strength dynamite. In softer materials often the reverse is true, viz: that the drilling cost is low proportionately. In a case like this it may be more economical to use closer hole spacings and a lower strength dynamite. Each quarryman should find the proper balance between the drilling cost and actual explosive cost. This applies whether well drills or tripod drills are used.

In any event the important thing in blasting is to break up the ground so that it can be handled easily and in the greatest volume by the shovels. If the digging is made easy, it means less wear and tear on the equipment, lower cost of upkeep and repairs, a greater output through the crusher and a lower final cost per ton.

The ground must be properly prepared for the blasting, that is, the holes must be drilled to proper depth and spaced with judgment in order to get the best results from the explosives used in them. I find in some quarries that often too much is expected of the explosive and not sufficient attention is given to spotting the holes. I have seen holes set so far apart and back that no explosive, no matter how strong, could possibly give satisfactory results.

Not long ago I heard a quarry superintendent say of a drill runner. "That man is one of the speediest runners I ever saw but he is very poor in spotting holes." This was a quarry using tripod drills and the point was brought out that the results from blasting were not so good as when holes were drilled by another man who used judgment in spotting the drill holes. It doesn't cost any more in the final analysis but rather it often means money saved to see that the holes are drilled correctly. If closer attention is given to the drilling, better results will be obtained than if sole dependence is put on the explosive. The degree of fragmentation of rock depends greatly on the distance apart between the holes. In well drill work, or for that matter even in tripod drilling, the mistake is often made of setting holes too far apart. I believe it is better to err in setting them a few feet farther back. Too much stress cannot be given to the importance of drilling in quarry operations. If this is done properly one has gone more than half way in arriving at a reasonable blasting cost.

Too much attention, I fear, is often given to the first cost of the explosive, forgetting the after costs. What the quarry operator is interested in is putting the stone on the cars at the lowest possible cost. I believe that this can often be obtained by closer attention right at the beginning of the work which is the drilling and blasting. It isn't the first cost so much but the final total cost that counts.

The main offices and sales force of the Knickerbocker Portland Cement Corp. have been transferred from New York City to the City Savings Bank Bldg., Albany, N. Y., chiefly because of more advantageous shipping facilities.

Bright Future For Lime Industry In Eastern Canada

It is predicted that the 1924 lime manufacturing season in New Brunswick will exceed all previous marks in volume. The 1922 season was one of the most satisfactory in many years. During the war period, the abnormal boom created a demand for lime that has been unprecedented. When the post-war level was found, there ensued a slump because of dullness in building construction all over America. Most of the lime manufactured in eastern Canada is exported to the United Srates, West Indies, Cuba, South America, Newfoundland, and to Europe. During 1923, the New England market accepted all of the Canadian lime it could secure. In the New England states, the building boom surpassed all previous conditions. In consequence of the demand from the New England states, many manufacturers who had not been producing lime for from one to three years, resumed operations. Exportation was by steamer and schooner to New England, although some of the lime was shipped by rail. However, the heavy freight charges militated against general shipment by rail.

The prices secured for Canadian lime during the 1923 season were better than for any previous season since the war period. And, as the operating costs were lower than during the war period, the profit was greater.

Preparations are being made for the entrance into lime manufacturing by a number of new companies and United States capital is interested in several of these projects. According to tentative plans, lime manufacturing plants will be built on the St. John river that will supply the needs of one construction concern alone. All of the lime manufacturers who operated their plants during 1923 expect to resume operations early in the spring. There is apparently an unlimited supply of lime rock available in the provinces of New Brunswick, Nova Scotia, Prince Edward Island and Quebec. In many instances lumbering companies are maintaining lime producing plants in conjunction with their saw mills.

Brown Coal in Cement Works

A discussion of the use of brown coal for cement works by Berner, is reviewed by C. C. Davis in *Chemical Abstracts*, and it is pointed out that contrary to prevailing opinion brown coal can be used successfully and even with economic advantage for power production in cement manufacturing. Boiler design for brown coal firing, the advantages of firing with brown coal, results already obtained with brown coal dust in revolving furnaces, the influence of brown coal ash on cement, the drying of wet coal, the grinding of dry coal and the cost of drying are discussed with illustrations in the paper abstracted. The advantages of conversion from an anthracite to a brown coal basis is stated to be dependent upon the proximity and quality of the brown coal. Assuming that brown coal is dried before use but that anthracite is used directly, it is recommended that all cement works whose cost per heat unit of anthracite is more than 23 to 25% higher than that of brown coal should be reconstructed for firing brown coal dust.

A Good Year for the Lime Industry

By William R. Phillips
General Manager, American Lime & Stone Co.

Abstracted from *Chemical and Metallurgical Engineering*.

The lime industry during the year 1923 has experienced, on the whole, a satisfactory year. The demand for lime in agricultural, construction and chemical fields, while not equal to the demands of the war period, has shown a healthy increase such as might be expected in a growing industry. Supply and demand have been fairly well balanced and prices have been about the same as in 1922. Competition has been from keen to sharp, particularly at certain periods in the year where seasonal influences are felt.

Competition on quality has become exceedingly keen, and is rapidly raising the entire lime industry to the plane of a highly developed chemical manufacturing business, a development that will more and more act to the benefit of lime users and undoubtedly, in the long run, to the benefit of the lime industry itself.

Higher Standards of Quality Demanded and Offered

Due to cooperation between leading lime manufacturers and leading consumers, new and higher standards of quality are rapidly being established. The physical and chemical properties necessary for different uses are being studied by both manufacturer and purchaser; the general terms "good lime" and "bad lime" are rapidly being recognized by consumers as insignificant or inadequate, and are being replaced by the technical terms describing the properties of the product best suited for each specific purpose.

Lime manufacturers are more and more placing their plants under the control of technically trained men for the purpose of manufacturing their product in such a way as to supply the physical and chemical properties best suited for the trade they aim to supply.

Noticeable Influx of Technical Men

The gradual influx of technically trained men to the lime industry, which has been lightly noticeable for the past few years, in 1923 reached a point where the demand for the services of such men is sacrcely equal to the supply. The future is certain to feel the effects of the works of these men, to the benefit of both manufacturer and consumer.

Improved Manufacturing Facilities

There has been a strong tendency on the part of lime manufacturers to improve their manufacturing facilities during the last year. The abandonment of old-fashioned kilns and methods in favor of new equipment and practices is progressing at such a rate that it is a matter of only a short time until the typical lime plant of five years ago must have gone with the past; its successor, the modern, efficient, laboratory-controlled, lime-manufacturing plant will have taken its place. The progress in this direction during 1923 has been greater than in any similar period in the history of the industry, and 1924 promises to set a new high mark in this direction.

Improved packing and shipping methods, particularly for chemical lime, such as air-tight steel drums and air-tight steel barrels, have become more in demand during 1923 to assure the retention of the purity and strength of the materials when they reach the consumer.

The demand for improved barrels for the building trade reached such a point in 1923 as to cause a large number of manufacturers to discard the common slack barrel so long in use for a higher grade tongue and grooved barrel to better protect the contents.

United Efforts for Research Work

There are several outstanding developments of 1923 that may reasonably be expected to exert a strong and lasting influence on the lime industry. Foremost among these is the stabilization of the National Lime Association for the purpose of continuing technical studies for the improvement of all lime products and their market.

This development is placed first in line because a careful analysis of other important developments in the industry brings out the fact that they all lead back to association work, and are either the direct accomplishments of this body or the indirect results coming from its work.

The permanence of this organization was assured during 1923 by the establishment of its financial support on a liberal basis for a period of 3 years, and this step places it in a position where it can devote its entire energy towards the technical problems of the industry, without having to face the dangers of dissolution each year, a danger always present in the past, especially if the industry encounters a poor year's business.

Directly attributable to this broad-gage policy of the leading lime manufacturers, we already have a number of concrete results that justify the policy they have adopted.

The Future

The lime industry looks toward the future with great confidence, feeling that the progress it is making within itself will cause it to share the bright future that seems to be certain for the entire country, and particularly the agricultural, building and chemical industries of the country. It feels that the coming year should be the best in its history, at least in so far as the broad principles of its advancement are concerned, and in volume of output the indications are for a healthy increase over the year just passed, with a possibility of demand closely approaching the possible maximum supply.

Thirty-two business men and road contractors visited Milltown, Ky., early in December, to witness what is said to have been one of the largest explosions ever touched off in the Middle West. Twenty-five thousand pounds of dynamite were detonated at a single blast at the quarries of the Louisville Cement Co. The charge blew up a ridge of solid limestone rock 400 ft. long, 108 ft. high, and 32 ft. wide. One hundred thousand tons of rock were removed by the charge.

Power Plant Management[1]

Efficient Utilization of Fuel Oil

By Robert June
Assoc. Member A. S. M. E.

The fact that coal prices have shown no tendency to recede in recent years has caused power plant operators in many sections of the country, not generally regarded as natural oil burning localities, to consider and frequently to adopt oil as a boiler fuel. In this paper we will deal first with the advantages and disadvantages of fuel oil, and then take up certain factors in the efficient use of fuel oil which have not heretofore been discussed at any great length in the many articles which have appeared in the press on this subject.

Comparative Cost of Oil and Coal

The first cost of oil and coal does not tell the story of the comparative advantages of these two fuels. Many other factors such as availability of supply, increased boiler efficiency, comparative labor costs, storage factors, etc., have to be taken into consideration. Nevertheless, our starting point is the actual direct comparison in cost of B.t.u. per pound for each fuel. Fig. 1 shows the comparative first cost of fuel oil. Table I, developed on a different basis, takes into consideration the variation in efficiency with the two fuels, but is based on a constant calorific value for coal and oil.

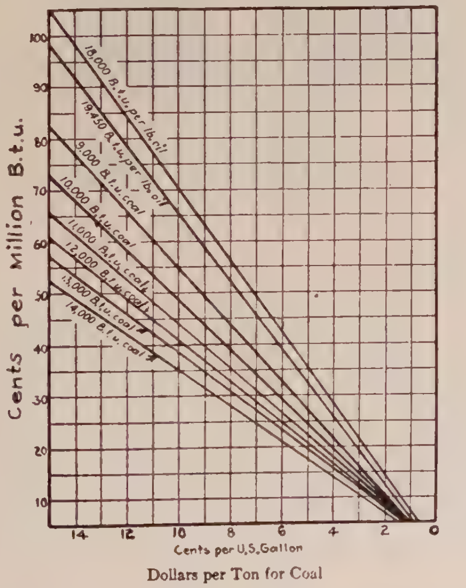


Fig. 1—Comparison in Cost Per Pound of Fuel

Advantages of Oil Fuel

1. Handling costs are reduced; the boiler-room staff is cut; fewer firemen, coal passers, helpers, etc., are required, the reduction being approximately in the ratio of five to one.
2. Ease of fire control, ignition, regulation. In an exigency, such as, for instance, a failure in water supply, the oil fire can be promptly extenguised. Much time is saved in bringing up the pressure: 150 lbs. can be secured from cold water in a half hour.
3. Since combustion is nearly perfect, much higher capacities and efficiencies obtain. Excess air is held to a minimum. The opening of furnace doors for cleaning or working of fires is dispensed with; furnace temperatures are, accordingly, almost constant.
4. Oil in storage does not lose its calorific value, as does coal. Moreover, there is little danger from spontaneous combustion.
5. The refuse from the combustion of fuel oil is insignificant, and of easy disposal. The boiler-room is free of ashes and dust. The equipment is spared the deleterious effects of such abrasives. Annoyance and damage to surrounding property is minimized.
6. Smoke can be practically eliminated.

Disadvantages of Oil Fuel

1. Fire Hazard: Apparatus using oil for fuel, however safeguarded, introduces a distinct hazard which should be recognized.
2. Storage: Oil storage not only offers more hazards than coal storage, but it frequently calls for the use of a great deal more space. The table of storage capacities permissible under laws of National Board of Fire Underwriters, shows that unlimited capacity may be stored at a minimum of thirty (30) feet from the nearest building line. The laws deal at length with the thickness and size of vent and fill pipes, cover boxes, indicators, filters, etc., making a complicated and expensive storage installation.
3. Reliability of Supply: Fuel oil must be transported in special cars and special delivery wagons of which there are a limited number available at any one time. Coal shipments so far exceed the shipments of oil that the transportation of coal is a chief source of revenue to the railroads. If coal cars should be delayed in transit, the roads would soon become blocked and demoralize the whole system of freight movement. Production of bituminous coal has always been adequate, the coal must be moved, consequently the supply has always proved reliable. Coal hauling by local teamsters is more flexible than depending upon one company for delivery of fuel in a tank wagon.
4. Price Stability: The history of the oil market shows wide variation in price, ranging from 2c per gallon up to as high as 7.5c. Present quotations are still subject to fluctuation and it is doubtful whether a contract could be made to guarantee a fixed reasonable price and delivery over a satisfactory period of time. The coal market, insofar as steam sizes go, has been very much more stable than the oil market. Moreover, coal prices today are regarded as near the top and any tendency to boost them seriously would meet with tremendous resistance all over the country. There is no such public sentiment against increases in oil prices as there is against increases in coal prices.
5. First cost of Equipment: A modern fuel oil

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[1] Copyright 1923, by Robert June.

plant consisting of duplicate storage tanks, oil heaters, pumps, etc., and reliable workmanship for its installation is estimated to cost approximately $30.00 per horsepower. Up to date, mechanical stoker equipment consisting of complete stokers, which will ordinarily outlast the life of an oil plant, auxiliary apparatus, including modern ash removal system and labor for installing should not exceed $18.00 per horsepower, a saving of nearly 40% over a fuel oil plant.

6. Boiler and furnace maintenance costs will be higher with oil, unless they are especially constructed for burning it. In localities where feed water tends to form considerable quantities of scale, the repair costs are likely to be much increased by reason of the intense temperature developed in the furnace.

Handling in Bulk

The decision as to whether to use fuel oil will depend entirely upon local conditions. The above points are suggestive of the factors which must be taken into account in considering use of oil in any given plant. The final decision will be made upon local conditions. Let us assume that oil is to be used. We have then the problem of handling it in bulk quantities. This presents a problem which has not been generally discussed.

Let us assume that we must take care of an average of one or more tank cars within each 24-hour period. Where gravity discharge is possible, it is desirable to place 10-in. pipes in a vertical position in the center of the rails and discharge the oil through these pipes into the storage tank. If several cars are customarily received at the plant at the same time, it may be well to put in several of these pipes, in which event they should be arranged with 43-ft. centers, as this is the length of the most commonly used tank cars. Threaded, or flanged caps, preferably threaded, should be provided for the 10-in. pipes, when not in use. The 4-in. discharge pipes of the car can be located directly over the 10-in. pipe with the result that when the car is properly heated, its contents may be discharged in one-half to three-quarters of an hour.

The 10-in. line should have a gate valve at the entrance to the tank or at the entrance of each tank, if branches are provided to more than one tank. As a matter of safety and also to comply with the insurance rules of some states, the filling pipe should enter the tank near the bottom, thus providing an oil seal which will prevent the possibility of any gas within the tank being ignited by means of a flame carried through the 10-in. line.

It is, of course, necessary to heat heavy oil whenever it is moved. This means that sortage tanks may be equipped with heating coils. Where tanks are located above the ground, the area of the heating coils will be largely determined by the climate. Where tanks are buried, approximately 35 ft. of ¾-in. steam pipe should be provided for each 10,000 gallons capacity.

It is quite a common mistake to bring oils to too high temperature when endeavoring to move from storage. This should be avoided because it wastes steam and therefore fuel, unnecessarily, and it does not make oil any easier to handle above a certain point. Should there be any water in the tank, as frequently happens, it may produce steam bubbles in the oil, causing foaming.

A good average safe temperature for handling oil out of storage is 125° F. In laying out steam lines, provision should be made for a ¾-in. line to the tank car.

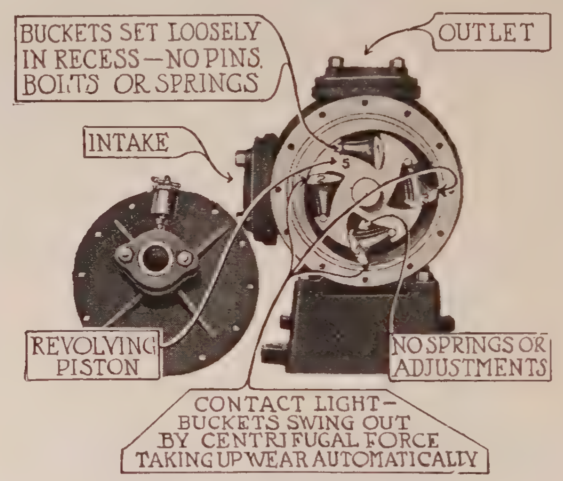
Best Pump for Oil Service

Rotary pumps are in use by thousands for handling oil and their popularity is well deserved. The rotary pump has so frequently demonstrated its advantages over the piston pump for this same service, that it is hardly necessary to describe at length the different actions of these two principles. Suffice to say that the rotary pump will handle a larger volume of liquid with less power than the piston pump. This is so because the action of the rotary pump is continuous.

When once started there is no stop or hesitation in the flow of liquid, whereas in reciprocating pumps, when the piston has reached the end of the stroke, it stops and with it stops the flow of liquid. It is a well established fact that it takes more power to start the movement of anything intermittently than it does to keep it moving when once started.

The three advantages of rotary action are: (1) Continuous flow with greater pumping volume (2) Saving in power, with consequent reduced cost of operation (3) Less slippage.

A typical rotary pump is illustrated in Fig. 2. It will be noted that the buckets are hung in the roter in such a way that they ride in the cylinder wall with extremely light contact, similar to a balanced flange valve on a steam engine. An important feature of the action is that the buckets take up their wear automatically, thus making a perfect seat on the cylinder wall at all times. The rotary pump, having a piston suction, need not be primed.


BUCKETS SET LOOSELY IN RECESS—NO PINS, BOLTS OR SPRINGS
OUTLET
INTAKE
REVOLVING PISTON
NO SPRINGS OR ADJUSTMENTS
CONTACT LIGHT—BUCKETS SWING OUT BY CENTRIFUGAL FORCE TAKING UP WEAR AUTOMATICALLY

Fif. 2—Typical Rotary Oil Pump

The piston revolves with the shaft, causing the buckets to hold out against the cylinder by centrifugal force and gravity. This exhausts the air from the suction line, allowing the atmospheric pressure to force the oil into the pump and fill the extension chamber. The oil is forced out of the discharge as it cannot carry by the discharge port, owing to the fact that the only oil that will carry by is that which fills the recesses in the piston and this acts as an oil packing, keeping the pump at all times suction tight.

Piping Systems

Where heavy oil is to be burned as fuel in boilers, special attention must be paid to the design and layout of the piping system between the tank and pumps, and between the pumps and the burners. All of the pumps should be located as close to the tank and at the same time, as close to the floor as possible, in order to reduce friction and suction lifts.

The intake line should be at least half an inch larger than the pump suction. The use of elbows should be avoided, long sweep bends being used in their places. Where the intake pipe lies along level ground for some

Table I—Relative Value of Coal and Oil Fuel

Gross Boiler Efficiency With Oil Fuel	Net Boiler Efficiency* With Oil Fuel	Net Evaporation from and at 212 Degrees Fahrenheit per Pound of Oil	Water Evaporated from and at 212 Degrees Fahrenheit per Pound of Coal							
			5	6	7	8	9	10	11	12
			Pounds of Oil Equal to One Pound of Coal							
73	71	13.54	.3963	.4431	.5170	.5909	.6647	.7386	.8124	.8863
74	72	13.73	.3642	.4370	.5099	.5827	.6556	.7283	.8011	.8740
75	73	13.92	.3592	.4310	.5029	.5747	.6466	.7184	.7903	.8621
76	74	14.11	.3544	.4253	.4961	.5670	.6378	.7087	.7796	.8505
77	75	14.30	.3497	.4196	.4895	.5594	.6294	.6993	.7692	.8392
78	76	14.49	.3451	.4141	.4831	.5521	.6211	.6901	.7591	.8281
79	77	14.68	.3406	.4087	.4768	.5450	.6131	.6812	.7493	.8174
80	78	14.87	.3363	.4035	.4708	.5380	.6053	.6725	.7398	.8070
81	79	15.06	.3320	.3984	.4648	.5312	.5976	.6640	.7304	.7968
82	80	15.25	.3279	.3934	.4590	.5246	.5902	.6557	.7213	.7869
83	81	15.44	.3238	.3886	.4534	.5181	.5829	.6447	.7125	.7722
		Net Evaporation from and at 212 Degrees Fahrenheit per Barrel of Oil	Barrels of Oil Equal to One Ton of Coal							
73	71	4549	2.198	2.638	3.077	3.516	3.955	4.395	4.835	5.275
74	72	4613	2.168	2.601	3.035	3.468	3.902	4.335	4.769	5.202
75	73	4677	2.138	2.565	2.993	3.420	3.848	4.275	4.703	5.131
76	74	4741	2.110	2.532	2.954	3.376	3.798	4.220	4.642	5.063
77	75	4807	2.082	2.498	2.914	3.330	3.746	4.162	4.578	4.994
78	76	4869	2.054	2.465	2.876	3.286	3.697	4.108	4.518	4.929
79	77	4932	2.027	2.433	2.838	3.243	3.649	4.054	4.460	4.865
80	78	4996	2.002	2.402	2.802	3.202	3.602	4.003	4.403	4.803
81	79	5060	1.976	2.371	2.767	3.162	3.557	3.952	4.348	4.743
82	80	5124	1.952	2.342	2.732	3.122	3.513	3.903	4.293	4.683
83	81	5187	1.927	2.313	2.699	3.085	3.470	3.856	4.241	4.627

*Net efficiency =gross efficiency less 2% for steam used in atomizing oil.
Heat value of oil—18500 B.t.u.

One ton of coal weighs 2000 pounds. One barrel of oil weighs 336 pounds. One gallon of oil weighs 8 pounds.

distance, it should be installed with a slope upwards of about one foot in 100, toward the pump. Care should be taken to see that pipes are placed either in dry, well drained ground, or in equally well drained wood or concrete trenches. In the northern states, piping subject to frost should be insulated. Discharge pipes from pump to burner should also be insulated.

It is quite frequently the practice to place a small live steam line inside the discharge line to supplement the oil heater. In such cases, expansion at the point where the small line is introduced is taken care of by provision of stuffing boxes. By putting in this small steam line, it is possible to heat the oil in the discharge line when starting up a cold installation. This is an important point as it greatly facilitates handling the heavy oil. Another piping detail which will greatly facilitate handling, is to run a circulating line from the far end of the discharge heater back to the suction tank. This makes it possible to circulate oil entirely through the system, in advance of firing the boilers—quite an advantage with heavy oils.

For piping of this sort, standard weight pipe and fittings can be used. However, real care should be exercised in selecting the valves, as cheap valves have a great tendency to leak.

In putting in piping for oil, joints should be made up with compound not affected by oil. For this purpose a mixture of litharge and glycerine is frequently used. However, to secure best results, this combination should be mixed in very small quantities and used as rapidly as mixed, for the reason that it sets very quickly and is, of course, of little value if the thread is not screwed on and the joint made before the compound has hardened.

Pointers on Efficient Operation

Oil should not be heated above its flash point in any part of the system except the burner. Such preheating will cause oil to become carbonized and to clog up the piping system, resulting in unsteady burning and the need for additional pressure to force oil through the clogged pipes.

When using a steam atomizing burner see that only enough steam is turned on to give a soft clear flame. Too much steam is not only wasteful, but cools the flame to a certain extent and develops the possibility of blow-torch action so damaging to brick work. A white flame indicates excessive steam. Regulate the steam for each burner at its respective steam valve. Constant attention should be given to this.

If the boiler is provided with a superheater see that superheated steam is used in preference to saturated steam as an atomizing agent for the oil.

Oil pressure should not exceed the pressure of the atomizing steam or air. If this occurs there is danger that the oil will lodge on the brick work at the back of the combustion chamber before combustion is complete. In general the steam or air pressure should be 5 lbs. greater than that of the oil.

When a boiler is down for repairs, particularly furnace repairs, take out the burner before any work is done inside. Damage to tips is always possible if the furnace is being worked upon.

Tanks made from old rotary coolers which have been used at the quarry of the Louisville Cement Co., Louisville, Ky., by men engaged in blasting, as a protection when blasts are fired, are described in *Successful Methods*. The tanks are converted into places of safety by merely closing up one end with heavy timbers and bolting 2 x 4 timbers on either side for the men to brace themselves against. These tanks can be rolled from place to place very readily, and can be stationed fairly close to the blast. This arrangement, it is claimed, has solved the problem of speeding up the work by enabling the men to get to and from a place of safety in much less time than would be required without the use of the steel tanks.

The first annual get-together dinner for the executives of the Vulcanite Cement Co., of Vulcanite, N. J., was held recently. William R. Dunn, general manager of the company, was toastmaster and speeches were delivered by Vincent Kichline, quarry foreman; S. H. Harrison, superintendent; S. Warren Hartwell, chief chemist; D. F. Baim, chief clerk; James Sitgreaves, Howard Leonard, William S. Stoneback and Morris Fegley, superintendent of the bag house.

Hercoblasting

By J. Barab
Hercules Powder Co.

Abstracted from a paper delivered at the seventh annual convention of the National Crushed Stone Association, St. Louis, Mo., Jan. 22, 1924.

In an article in the April, 1923, issue of *The Explosives Engineer*, T. W. Bacchus described a new blasting method, called Hercoblasting, which it was then believed would effect large reductions in the cost of explosives on operations to which it is applicable.

Mr. Bacchus' article explains the method in detail. When it was written, only a limited number of field trials had been made, but since then Hercoblasting has been tried in various kinds of open-pit operations, and has been adopted by a number of them. Reports from every trial have been highly satisfactory. This paper will summarize the experience of a number of explosives users who have profitably employed Hercoblasting on various kinds of work, and will only touch on points in connection with the practice of the method which demand special consideration.

In Hercoblasting, black blasting powder is used with Cordeau-Bickford detonating fuse in column loads. Due to its slowness, black powder cannot be used satisfactorily in column loading without detonating fuse; but Cordeau-Bickford imparts to it a longitudinal velocity of approximately 17,000 ft. per second; and, speeded up in this way, black powder gives results on certain work, equal in every way to those produced by high explosives. From the following Table 1, which indicates the quantities of black powder required to replace 100 pounds of various grades of high explosives, and compares the cost, the saving effected by Hercoblasting can be clearly seen.

Table 1.

Using High Explosives		Hercoblasting Method			
Brand	Cost per 100 lbs. C/L price in Penna.	Lbs. Hercoblasting pdr. required to replace 100 lbs. high explosives	Cost per 100 lbs. Hercoblasting pdr. in 800 keg lots, Penna.	Cost of Hercoblasting pdr. necessary to replace 100 lbs. of high explosives	Percent saving by replacing high explosive by Hercoblasting
30% L. F. Extra...	$12.50	100 lbs.	$6.80	$6.80	45.6%
40% L. F. Extra...	13.25	125	6.80	8.50	35.8
Special No. 1......	14.25	150	6.80	10.20	28.4
Special No. 2......	13.25	125 to 150	6.80	8.50 to 10.20	28.4 to 35.8

As Cordeau-Bickford is used to a large extent with high explosives, many operators can use this table for a direct cost comparison between black powder and dynamite; but where Cordeau-Bickford is not ordinarily used, its cost, less the cost of the electric blasting caps which it replaces, should be added to the costs shown in the table for Hercoblasting.

Black powder cannot be used satisfactorily in holes that contain a large amount of water, or when water is continually flowing into the holes. In such cases, we do not recommend its use. But where there is only a small quantity of water in the bottom of the hole, Hercoblasting is successful if the hole is loaded with high explosives to a point above the water level, and with black powder for the rest of the distance.

Although any of the smaller granulations of black blasting powder may be used, a special granulation, known as *Herco* granulation, is the most satisfactory for this purpose. Herco blasting powder is composed of various sized granulations. In a charge of uniform granulation black powder there is always a large amount of air space; but in Herco blasting powder the granulations are mixed in such proportion that the smaller grains fill most of the voids between the larger ones, and this makes it possible to load more powder by weight in a given volume of space. The difference in the apparent density between a charge of Hercoblasting powder and a charge of ordinary black blasting powder is indicated in Fig. 1.

Ordinarily we do not speak of black powder as having a definite strength in the same sense that dynamite has. However, we have found that a great deal of work requiring high explosives of from 30 to 40% bulk strength can be successfully accomplished with Herco blasting powder. Table No. 2 shows typical results obtained throughout the country in open pit operations of many kinds.

Table 2—Typical Results with Hercoblasting

Type of Work	Ordinarily Used	Method of Replacement	Actual Saving in Percent of Explos. Cost
An Anthracite Stripping Operation	Black powder in sprung holes	Regular Hercoblasting	21%
An Anthracite Stripping Operation	Special No. 1	Some high explosives in bottom of hole 1½ lbs. black powder displacing 1 lb. Special No. 1	20
AnAnthracite Stripping Operation	Special No. 1	Some high explosives in bottom of hole and less than 1½ lbs. black powder displacing 1 lb. Special No. 1	29.5
An Anthracite Stripping Operation	Special No. 1	Special No. 1 in bottom and 1½ lbs. Black powder displacing 1 lb. Sp. No. 1 for remainder	19
An Anthracite Stripping Operation	Special No. 1	Special No. 1 in bottom and less than 1½ lbs. black powder displacing 1 lb. Sp. No. 1 for remainder	31
A Missouri Cement Quarry	Special No. 1	1½ lbs. black powder displacing 1 lb. Sp. No. 1	23.8
A Texas Cement Quarry	Various grades from 30% to 60%	Black powder loaded pound for pound against high explosives	31
A Pennsylvania Cement Quarry	30% & 50% Extra	Some 50% Extra in bottom and remainder black powder loaded pound for pound against 30% Extra L. F.	42
A Wisconsin Lime & Cement Quarry	40% Gelatin	125 lbs. black powder displacing 100 lbs. 40% gelatin	30
A Tennessee Cement Quarry	40% Nitrostarch	Black powder loaded pound for pound against 40% Nitrostarch powder	35
A Tennessee Limestone Quarry	40 & 60% Nitrostarch	On account of holes being wet on bottom 150 to 200 lbs. high explosives were in bottom of hole—but for the remainder black powder was used pound for pound against nitrostarch powder.	39
An Ohio Limestone Quarry	Special No. 1	Less than 1½ lbs. black powder displacing 1 lb. Special No. 1	33
A Michigan Limestone Quarry	Special No. 1 Special No. 1	Less than 1½ lbs. black powder used in place of 1 lb. Special No. 1	33
A Pennsylvania Flux Limestone Quarry	40% Extra LF	1¼ lbs. black powder displacing 1 lb. 40% Extra L. F.	33
A Michigan Limestone Quarry	40% Extra	1¼ lbs. black powder displacing 1 lb. 40% Extra	33
A Tennessee Stone Quarry	40% Nitrostarch	50 lbs. nitrostarch in bottom and for remainder 1 lb. black powder displacing 1 lb. nitrostarch explosive	41

Table 1 indicates that a saving of from 28.4% to 45.6% may be expected by displacing high explosives with black blasting powder; but this table is based on a direct and complete substitution, which is not always possible.

Table 2 shows savings that have been made on different operations. The actual saving will, of course, depend on the extent to which Hercoblasting powder is substituted for high explosives.

Fig. 2 illustrates the method of loading a blast in a Tennessee limestone quarry, where, by proper distribution of explosives, the rock was broken into a very convenient handling size.

Fig. 3 is another illustration of proper distribution of explosives for breaking the rock into practical size. This represents the method employed at a Pennsylvania cement quarry.

The great difference in velocity of explosion between black powder and even moderately strong high explosives makes it difficult for many to believe that the former can do the work of the latter. Those who are troubled with doubts on this score should remember

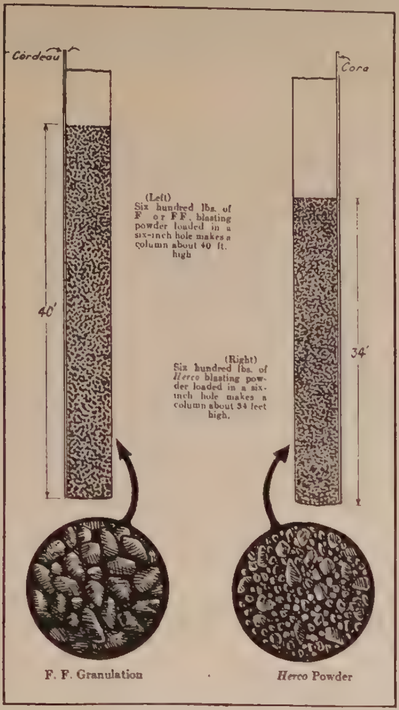

Cordeau
Cord
40'
34'
(Left)
Six hundred lbs. of F or FF. blasting powder loaded in a six-inch hole makes a column about 40 ft. high
(Right)
Six hundred lbs. of Herco blasting powder loaded in a six-inch hole makes a column about 34 feet high.
F. F. Granulation
Herco Powder

Fig. 1—With Herco Blasting Powder a Heavier Explosives Charge is Concentrated at the Toe Where it is Most Needed

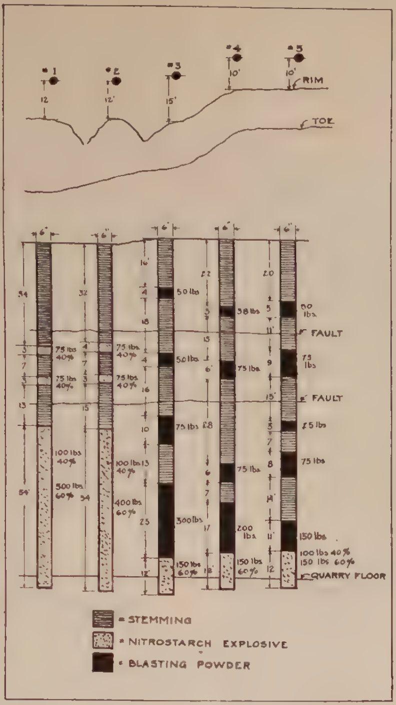


Fig. 2—Loading Log at a Tennessee Limestone Quarry. (The 2 Holes on the Left Were Loaded with Nitrostarch Explosive, the 3 Holes on the Right Were Hercoblasted)

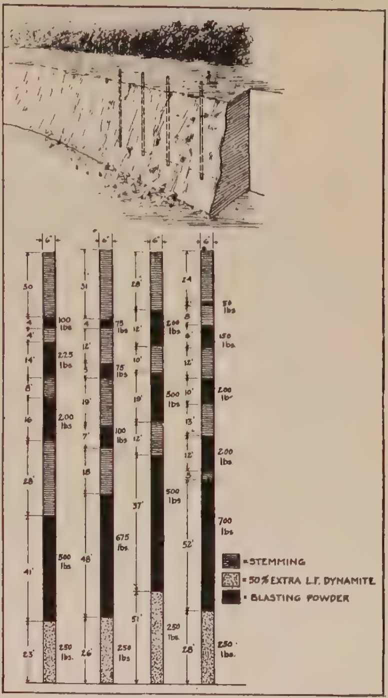


Fig. 3—Loading Log for a Hercoblast at a Pennsylvania Cement Quarry

that even the strongest high explosives exert their shattering effect over a strictly localized area. Hercoblasting is recommended only in well drill holes, and these are usually spaced at least 15 ft. apart, and often as much as 25 or 30 ft. apart, with a burden somewhat greater than their spacing. On such work, the type of explosives used has very little effect on the degree of fineness to which the major portion of the rock is broken. In open-pit operations it is only necessary to use an explosive strong enough to throw down the material and to have the explosive properly distributed. The distribution is probably the most important factor in breaking the rock to the required size. An explosive of greater strength or velocity than is actually needed to break down the material will not appreciably increase the amount of rock of a convenient size, though it will pulverize more of it adjacent to the charge.

Experience has shown that in many cases Herco blasting powder shot with Cordeau-Bickford is strong enough and quick enough to break the rock, and where this is so, the ideal method is closely approached in Hercoblasting. In all the blasts of which we have record, the rock has been exceptionally well broken, and in limestone the advantage over high explosives is increased, because here the fines are often a waste product.

A word of caution is necessary, because of the inflammability of black powder. Due consideration should be given to this, and all necessary precautions should be taken wherever there is danger from flying sparks or flame from steam shovels, locomotives, and other sources.

We have every reason to feel gratified at the success attained by Hercoblasting. Practically every trial has created an enthusiastic partisan for it. We are anxious to maintain this record, and we know that we can do so unless the method is employed unadvisedly under conditions for which it is not adapted. To guard against this, we advise any of you who are considering Hercoblasting to study the matter carefully before going ahead. If the company which I represent can be of any assistance to you in determining whether or not Hercoblasting is suitable to the conditions you have to meet, we are at your service. If it is, you may be sure that it will give you equal breakage at lower cost.

C. H. Boynton, cement manufacturer of New York City, has been appointed a member of an advisory committee by Secretary of Commerce, Herbert Hoover, to make a comprehensive survey of the properties and uses of cement and concrete. The committee will cooperate with the Bureau of Standards and officials of the Department of Commerce. Other members of the committee are: John Lyle Harrington, engineer, Kansas City, Mo., who is chairman; N. Max Dunning, architect, Chicago; H. C. Turner, contractor, New York City; Charles M. Upham, highway engineer, Raleigh, N. C.

A new form of blasting is to be followed out at the quarry of the Tidewater Portland Cement Co., Union Bridge, Md. A 4-ft. hole is being drilled into the quarry base to be extended back approximately 50 ft. At the end of this tunnel, drilling will be carried a distance of 50 ft. each way at right angles to the original hole and parallel to the quarry face. The explosives will be placed in the chambers, the extreme ends of which will be 100 ft. apart. The work will require several months before drilling is completed, and it is expected that many thousand tons of rock will be loosened by the blast.

Oregon cement mills have been producing successfully with a good demand for the product reported. The Oregon Portland Cement Co.'s plant has a record for production with one kiln. The Sun Portland Cement Co.'s plant, located in eastern Oregon, commenced operation last December.

Cement Industry in Great Britain

By H. C. Badder
London, England

There are 72 portland cement works in Great Britain of which 62 are in England; many are grouped in districts where raw materials are in abundance and cheaply won. Some 27 cement works are located on the Thames and Medway near to London; 15 are on the east coast, another 7 works are in the Midland counties, another 7 on the west coast, and some 6 works in other districts, not allied to the groups. There are also 8 works in Scotland and Wales, and 2 in Ireland.

The capacity is about 4,000,000 tons of cement per year, but sales have not reached this quantity, in fact some of the large cement works have not exceeded half capacity during the past year, this result being mainly caused by reduced export requirements.

Before the year 1900, manufacturers of portland cement were in great competition, and for large contracts prices were quoted that in many cases were less than cost of production. In that year The Associated Portland Cement Co., Ltd., was organized to take over a number of cement works, and at this date the Association owns some 15 works, and controls the output of a few others. The British Association was also formed by other manufacturers. Both however were in the hands of Builders' Merchants who to a great extent controlled sales so thoroughly that they were able to demand increased commission and discounts that, in some cases, exceeded 20%.

To overcome this extortion, a sales company was formed to supply users of cement direct, and The Cement Marketing Co., Ltd. slowly made progress until at this date it handles the production of between 30 and 40 cement works with its own barges, lorries and warehouses. This sales company is also supplying gravel and sand, lime, Keenes, and similar cements.

The proposals made since the War by the Government and private interests to expend some billions of dollars upon the construction of concrete highways and fast motor freight roads is going to have a great effect upon cement; and there has been great interest shown in portland cement companies, and there is a struggle for position in view of the immense orders to be placed for cement.

In this connection rumors were heard in October last that big financial interests had become interested because the political party in power was proposing a tariff to prevent the importation of any materials, raw or manufactured, that reduced employment in England. This would affect portland cement, which is imported from Belgium and France.

There is little doubt manufacturers of certain materials and many business men thought the Government would succeed until the election knocked the bottom out of these proposals.

On the 7th of November the *Press* published a story that a syndicate, The Anglo-Atlantic Corporation, had gained control of the Associated Portland Cement Co., Ltd. for American interests. This was denied by the secretary and later by the chairman of the Associated Portland Cement Manufacturers, the latter stating that Sir Philip Nash, chairman of the Anglo-Atlantic Corporation, asked him to state "the corporation was a British concern and that they were working in friendly cooperation" which he had pleasure in doing.

Really the subject is connected with new British groupings in the cement industry. Money is being found in London to construct cement works abroad like those in British Columbia. Mexico, and elsewhere; and efforts are being made to further consolidate interests at home to prevent competition and keep prices at a profitable level.

It may be added that competition is not only from portland cement companies. A story is being told in London that a manufacturer of hydraulic lime is supplying a thousand tons per week for the new Tube Railway extensions, on the grounds that it is better to use for grouting behind the metal shields than portland cement because it expands in setting when used neat, without sand.

No doubt a period of trust combinations are developing in England. Cotton has, steel is, and portland cement will form a combine to control supplies and prices. Every country, it seems, must buy its own experience rather than be taught by what has happened in other countries along these lines.

Accident Prevention in America

Demonstrating the remarkable growth of the industrial safety movement in the United States, by lantern slides, motion pictures, photographs and posters used in accident prevention work in that country, W. H. Cameron, managing director of the National Safety Council of the United States, recently addressed the International Labor Conference of the League of Nations, in Geneva, Switzerland on "Accident Prevention in America." Mr. Cameron, who spoke on invitation of the League of Nations, said in part:

> The safety problem is a world problem. Its solution is of vital importance in our international industrial life. The prosperity of any nation depends on the productiveness of its workers, which in turn depends to a large extent on their safety, health and welfare. Stopping the tremendous waste of accidents will improve the condition of industry of the worker and of the nation as a whole.
>
> With the cooperation of employes, of governments and of the League of Nations, great strides in accident prevention are possible. I firmly believe that the time is not far distant when accidental death and serious injury will be the exception. Earnest effort in reducing the casualties of peace is an expression of the highest type of patriotism to one's country and of service to humanity as a whole.
>
> Of much significance to us in America has been the inability of any government to arouse the enthusiastic interest of the employer in accident prevention by a blind method of labor law enforcement, the use of the "policeman's club." We have found that when the governmental authorities express a sympathetic interest in the complicated task of the employer and his safety problem; invite him to participate in the making of the safety laws through committees; encourage him to eliminate the accident hazards by showing him how to do so, and advocate and assist in the introduction of safety organization, then—and only then—has respect for the law resulted and with it a more ready spirit of conformity.
>
> The American method of solving the accident problem is a democratic one. The individual industry determines its own method. The safety organization and methods are likely to be evolved through conviction that the principle is right and not because the task or the requirement is imposed by the state. If there is a distinctive note in the American method of technique for minimizing accidents, it is the manifestation of a real industrial democracy, the method and results depending upon the cooperation of employer and employe, In many instances this has led to a better understanding of industrial problems and has shown the possibilities of effective cooperation.
>
> Safety will never have universal acceptance until its constructive and reasonable aspects become universally known. The words "Safety First" have done serious injury. This slogan is negative and destructive. No permanent advance in civilization is made on a negative principle. The inner meaning of safety is the preservation of life to continue the adventure of life. If life is worth while, if it is worth continuing, then the safe piloting of life's adventure must depend upon facing the risks of life fearlessly but with a knowledge of their inherent qualities. Some of the thrill of life is in meeting its dangers. Our workers, our citizens must first understand what safety is; it must become a desirable and sought for attribute of living. It must be worked into the habits and consciousness of children as they are taught to talk and live.

Lack of Cooperation in English Cement Field

Mr. G. A. Watson, chairman and managing director, Ship Canal Portland Cement Manufacturers, Ltd., at the twelfth annual general meeting of the shareholders, said:

"I want to refer again to the demands for cement. Many people have asked me my opinion as to the reason why the U. S. A., whose production not so many years ago was negligible, is now producing and using 20,000,000 tons of cement per annum, whereas the United Kingdom productive capacity has stood still at about 3,000,000, and at the moment it is a good deal less than this.

"I have replied that the U. S. A., being a new country, wisely had adopted the very commodity that lends itself to construction work of all kinds. But then, say my friends, how is it that the United Kingdom, situated in such a favored natural position for distribution, has not in any marked measure increased its markets at home and abroad? My answer to this has been that, in my opinion, the cement trade has not, as a whole, adopted a policy of propaganda to educate the potential consumer in the uses of cement, and that my desire ever since I have been in the cement industry has been to persuade the trade as a whole to adopt a full-blooded propaganda policy to popularize this essential commodity. In my view, this propaganda should have been conducted by unremitting pressure through Press advertisements, also by demonstration and in many other ways. But no; our big friends had collared the bowling, and they would not let us—the outsiders—in the game. Now, quite recently, I got another and what, to my mind, is a far-reaching light on a possible cause of the paucity of demand in this country as compared with the ratio of demand in the United States. It is contained in a report from our works manager, reporting the visit to our works of a prominent American engineer, which proceeds to say:—'Mr. X. visited our works with friends. Mr. X. is an American engineer who had come over to study the conditions prevailing in the cement industry in this country and on the continent. Mr. X. mentioned that he was particularly impressed by the absence of cooperation between the manufacturers and all interested in cement in this country. The manufacturers by their attitude seem anxious to kill the industry, and to go out of their way to belittle cement made by their competitors, thus discouraging the engineer and architect from using portland cement, Mr. X.'s view being that if by their selling propaganda, manufacturers put users, architects, surveyors, etc., against other brands of cement by running them down, they are doing the industry an injury in bringing doubt in their minds as to cement being a satisfactory building material. In the United States the manufacturers have conventions arranged with the sole object of bringing good feeling between all parties interested in cement; they boom the industry and give every one interested confidence in the use of cement as a building material to be relied on. I have put this point to others, and they agree entirely with Mr. X's criticism of English methods of propaganda.'

"Now, there is no country producing better cement than this country, and it seems a pity in this, the country of its invention, that any sales methods should be tolerated other than for the widening of its use at home and abroad." — *Quarry Managers' Journal* (Carnarvon, England).

While the 82,000,000 cu. ft. natural gas well uncovered near the city of Fort Collins, Colo., continued to flow after a month, cement executives in the vicinity of Denver are a little disappointed in news to the effect that the big well was churning itself into oil. It is expected that the pioneer movement will be followed up and other gas wells will be uncorked. It is reported that expert advice is to the effect that the well is good for at least 17 years.

A statement attributed to J. E. Zahn, general manager of the United States Portland Cement Co., Denver, is to the effect that as the gas field develops, industry will thrive as all industry will benefit from the gas discovery. Natural gas has been used with great success in the manufacture of cement and the development of one industry will help another and the state will prosper.

The story of cement, from the Appian way, built in 1300 B.C., to present-day development, was presented to the members of the Lions' Club, at Allentown recently, in a manner which explained the growth of the Lehigh Portland Cement Co. to its present position. Howard Rhode, service manager for the company, as the speaker for Thomas P. Refbord, chairman of the meeting, told the Lions many things about cement, its origin and uses. He stripped his talk from all technical terms, and with lantern slides illustrated the various phases of its manufacture.

The Brazilian International Centennial Exposition, recently held at Rio de Janeiro, has awarded the grand prize to E. I. du Pont de Nemours & Co. for its exhibit of dynamite, caps and fuse. The du Pont exhibit won the grand prize in competition with products of the same type exhibited by other manufacturers.

The regular annual meeting of the stockholders of the Lehigh Portland Cement Co. was held in January, at Allentown, Pa. The meeting was held for the purpose of electing directors for the ensuing year, and to take action on the approval or disapproval of the proposed increase of the capital stock of the company from $25,000,000 to $30,000,000.

A new one-reel motion picture has been completed by the E. I. du Pont de Nemours & Co., entitled "Dynamite at Work," which shows the use of that explosive in various parts of the country and under various conditions. Views of some of the largest dynamite shots made during the past year, where thousands of pounds of the explosives were used, are featured. One highly interesting view is that of a slow motion picture shot of some 45,000 lbs. of dynamite taken in a quarry. Other interesting views show the breaking of an ice jam, tearing down an old building, digging ditches in mosquito control work, blowing out stumps, and clearing roads of snow in the Rocky Mountains.

Another picture entitled "Dynamite in Quarry Work," has also been prepared. This is also a one-reel picture. Both pictures are available on request to the company.

The index to Vol. 23, July to December, 1923, of the Cement Mill Section of CONCRETE will be sent to subscribers who request it.

Men and Mills

Notes from the Field

Although the Peerless Portland Cement Co. has increased its capital stock to $5,000,000 and is to build a new factory in Detroit, this will in no way affect the Union City factory, excepting, no doubt, to still further increase its efficiency and output.

The Union City plant is to continue in operation as heretofore, and as soon as the annual shut-down occurs early in the year, great improvement will be made in the equipment. More than $50,000 will be expended in new machinery, including the installation of a new 1,000 K. W. turbine steam engine, to replace the old engine which has been in use for some years.

The marl beds at Spring Arbor contain lime deposits sufficient to last at least 20 years longer, while the company's clay beds south of Union City contain an almost inexhaustible supply of this material.

The condemnation suit of the D. & M. R. R. against the Thunder Bay Limestone Co. in the Alpena probate court has been decided in favor of the railroad, granting it authority to cross the Thunder Bay Limestone Co.'s land at the point it desires, and assessing damages in favor of the Limestone company in the sum of $518.75.

The sale of the Cebu Portland Cement Co., one of the National Development enterprises, to C. F. Massey, or interests represented by him, is reported in the *New York Commercial*, the signing of the contract of sale being the only step lacking to complete the deal, according to Governor General Wood. The terms of the contract, can not be made public until the papers are signed.

Whatever the terms, according to the chief executive, they are for the best interests of the Government and the people. It is understood the Cebu Portland Cement Co. will not cancel its contract with the Philippine Government to supply the latter with all the cement it needs.

The Lehigh Valley Section of the American Chemical Society was addressed recently by one of the leading men of the cement business, Prof. Duff Abrams, who has been in charge of the Structural Materials Research Laboratory at the Lewis Institute, in Chicago, since 1914.

A recent fire of unknown origin did more than $50,000 damage when the bag house and packing house of the Giant Portland Cement Co., located between Coplay and Egypt, at the Central mill were entirely destroyed with all packing machinery and about 1,000,000 cement bags.

John L. Marsters has resigned as superintendent of the Rockport plant of the Kelley Island Lime & Transport Co., according to advices from the headquarters of the company at Cleveland, O.

The new loading apparatus at the docks of the Michigan Alkali Co. was put into commission for the first time recently when the steel freighter Huron took on a cargo of stone for Wyandotte. Under the old arrangement, the battery of hoppers would only partly fill the ship, a delay being necessary while the train crews refilled the hoppers. Under the new system, after the hoppers on the south side have been unloaded, a conveying system from the hoppers on the north side is brought into play completing the loading from the north bunkers, thereby saving the time expended in refilling the hoppers.

At the recent annual meeting of the Northwestern States Portland Cement Co. the only change in directorship and officers was the selection of Hanford MacNider as treasurer to take the place of Fred Keeler.

The Atlas Portland Cement Co. has leased a large tract of land along the Ridge in Eldred and Ross townships, Monroe county, Pa., and reports from the district state that the company will continue to mine the clay products there on a large scale. It is stated that as some of the lodes of the company run out, negotiations are at once concluded for the extension. It is expected that in time a large number of men will be engaged in mining and hauling the clay.

A very heavy blast, through which the face of the Coplay Cement Manufacturing Co.'s quarry was blown out by explosives from sixteen holes, was recently set off.

The Alpha Portland Cement Co.'s mill, near Catskill, N. Y., 2,500 bbls. per day capacity, resumed full operations the first of the year, after a short shut down.

The Acme Cement Co. has had a very busy season, delaying the usual shut down until the first of the year. It is expected to resume operation about the 1st of February.

John Bainbridge, travelling representative erector for the Traylor Engineering Co., Allentown, Pa., has recently returned from a business trip to Los Angeles, Calif., where he installed one of the largest cement kilns in the United States for the Monolith Cement Co.

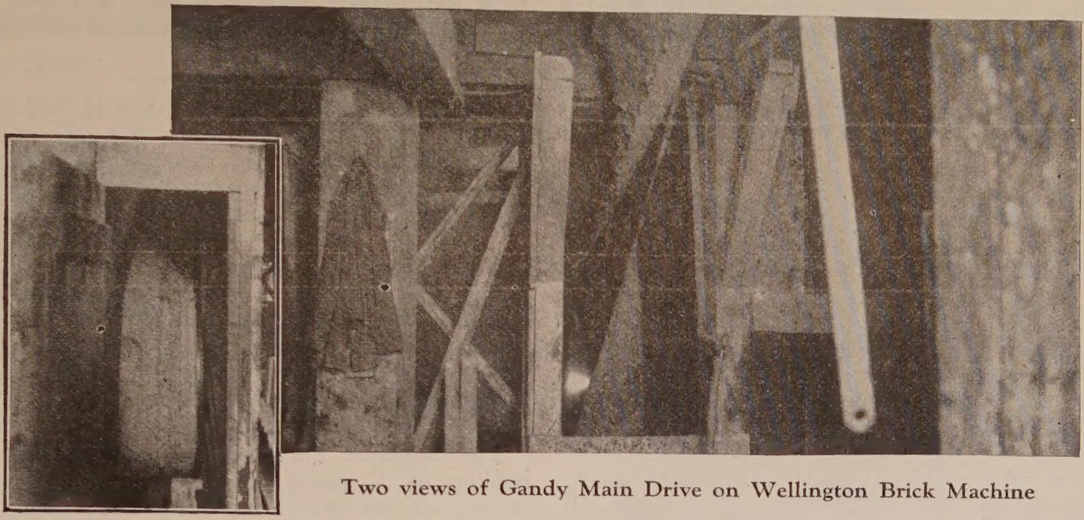
Fred Wood, formerly superintendent of the Hercules Cement Co., has recently purchased the Nazareth Paper Box Factory from the estate of the late Dr. O. D. Shaffer. About a year ago, Mr. Wood resigned from the Hercules company and accepted a position with the Coplay Cement Manufacturing Co. as superintendent of quarries.

The Joplin, Mo. office of The Dorr Co., engineers, was closed on January 1, 1924 and all future work of that office will be carried on by the Denver office.

T. A. Plimley, diamond drill expert of the Lehigh Portland Cement Co., left December 13 for Los Angeles, Calif., where he will spend a vacation of four months duration.

Extensive improvements are being made in Mill C of the Coplay Cement Manufacturing Co., Coplay, Pa., which include replacing a number of kilns with larger ones of a modern type.

Seventy-five engineers inspected the Oswego plant of the Oregon Portland Cement Co. recently and listened to an explanation of the process of manufacture by L. C. Newlands, manager. The trip was made by members of the Oregon chapter of the American Association of Engineers and the Portland society of the American Military Engineers.



Two views of Gandy Main Drive on Wellington Brick Machine

A GANDY *that sold a* GANDY

CONCRETE and ceramic mill conditions are different, but the figures given below ought to convince you that this Gandy showed the quality you are looking for.

Operating on a short center, high speed, full cross drive in the plant of the Mutton Hollow Fire Brick Company, this Gandy Belt proved that it had quality built into every inch.

Put on in February 1922, this belt is ragged now, but the following data prove that it has already outlasted mady high priced belts under similar conditions.

Here are the figures: The belt is 16" 7 ply x 42½ ft. length driving a Wellington Brick Machine. The 7 ply was decided upon in order to take care of the small drive pulley, which is only 20" in diameter and runs at 190 r. p. m. The driven pulley is 48" in diameter. Power transmitted—50 h. p. Added to these none to easy specifications was the fact that the belt must be run as a full cross drive in order to get a change of direction.

Portable conveyor owned by the same concern. Original belting equipment replaced by Thermo - Gandy. The owners say: "It has given much longer service than the belt replaced, is unaffected by weather conditions, and the first cost was a great deal less."

The Gandy has stood the gaff! Strongest proof of all, it has sold another Gandy.

There is nothing like satisfactory service to prove the real value of a belt—and Gandy is the best belt you can buy for the heavy work required of belts in cement and allied plants. Gandy Belt is supreme on heavy jobs—cost less to buy, last longer *per dollar.*

Why not prove for yourself that Gandy is the best buy? Put a Gandy on the toughest job in your plant.

THE GANDY BELTING COMPANY

GENERAL OFFICES AND PLANT: 762 WEST PRATT STREET BALTIMORE, MARYLAND
NEW YORK OFFICE: 36 WARREN STREET
CHICAGO OFFICE: 552 W. ADAMS STREET

MANUFACTURERS OF

GANDY STITCHED COTTON DUCK BELT Originated 1880 —still, best in service and cost for many installations.

THE THERMO - GANDY BELT a black, mineral - treated, heat and moisture-resisting belt.

GANDY BELT DRESSING —stick and paste, keeps fabric belts soft and pliable.

LOOK FOR THE GREEN EDGE AND THE GANDY TRADE MARK

The Choctaw Portland Cement Co., bankrupt, is offered at public sale, February 19, 1924, at McAlester, Okla., with all its real estate. Also, all factories, shops, warehouses, office buildings, chemical and physical laboratories, trestles, conveyors, hoists, excavating machinery, rock crushers, tracks, locomotives, cars, and all other buildings, utilities, machines, implements, tools and appliances of every kind located upon the property of the Choctaw company are included. W. D. Ege, 211 Lorton Bldg., Tulsa, Okla., is the Trustee in Bankruptcy.

The Whitehall Cement Co. is making extensive improvements to the property recently acquired from the Northampton Brewing Co. getting it into shape to house employes.

The cement industry has never been so active in Catasauqua as at the present time. Other industries in this section are normal, and employment is good. Few men are out of work.

The cement plant of the Tidewater Portland Cement Co. is undergoing its annual overhauling and still running on a 50% production basis. The outlook for next season's demand is most promising.

The plant of the Hudson Valley Cement Co., formerly Alsen Co., has been running at full capacity with no shut down.

J. E. Zahn, general manager of the United States Portland Cement Co., Denver, addressed the Denver Civic and Commercial Association at a recent meeting. Taking up the present and future business outlook for Denver and the surrounding country, Mr. Zahn called attention to the new $3,000,000 Burlington railroad shops, the boring of the Moffat tunnel, and oil finding in the state.

Clark M. Moore, Denver, Colo., vice-president of the International Cement Corp., of New York, died recently, after an illness of more than a year.

At its annual meeting, held in Denver, Colo., January 10, the Cement Securities Co. re-elected all directors, and the following officers, who are directors, were re-elected: Charles Boettcher, president; C. K. Boettcher, vice-president; Harry C. James, vice-president and treasurer; R. J. Morse, vice-president and secretary. Robert S. Gast, of Pueblo, was elected a director to fill the place of the late M. D. Thatcher.

W. Y. Stroh, president of Stroh Steel Hardening Process Co., Pittsburgh, Pa., leaves for Europe about the middle of February for an extended study of foreign markets.

Increasing business with South Africa, New Zealand, and Australia has made it seem desirable to establish production in Great Britain. The company is running to capacity and designing enlargements so that 1924 gives evidence of being a good year for Stroh process steel.

The Stroh process is a method for casting the finest alloy steel together with ordinary soft steel in one solid piece. The resultant casting has a wear-proof alloy steel stratum upon the wearing surfaces while the body is composed of any desired steel, and is in no way affected.

The heads of the operating department of the Tidewater Portland Cement Co., of Union Bridge, Md., were banqueted at the Hotel Rennert, Baltimore, recently by B. T. Scott, the president of the company.

The Alabama public service commission has denied a petition filed by all of the railroads operating in Alabama for authority to revise the minimum carload rate on cement, when shipped in mixed carloads with wall plaster, plaster of paris, gypsum, lime, etc., to 50,000 lbs. The present minimum rates are around 30,000 lbs.

The Atlas Portland Cement Co. is building a large cement sack factory at Leeds, Ala., 17 miles east of Birmingham. Charles F. Lewis is the superintendent of this work. When completed, this plant will employ about 100 people in making sacks.

Good progress is being made with the waste heat boiler system which is being installed for the Pennsylvania Cement Co., near Bath, Pa., by the Edge Moor Iron Co. The foundations are being installed by the Turner Construction Co. in accordance with the plans of the Edge Moor Co.

The Superior Portland Cement Co. has issued a booklet of 22 pages, describing and illustrating the process of manufacturing Superior portland cement. The illustrations are arranged in order, showing the various steps in the process of manufacturing from the quarrying of the rock to the shipping of the finished product.

J. B. John, well known in the cement manufacturing field, has been elected president and general manager of the Sandusky Cement Co., with headquarters at Cleveland, Ohio. Mr. John's connection with the Sandusky company is not a matter of recent history. He was retained, about two years ago, as consulting engineer on the Sandusky company's new gray cement plant at Silica, Ohio, near Toledo, which enterprise is now classed among the most modern and complete in the portland cement industry.

Following the death, late in 1922, of Dr. S. B. Newberry, former president and general manager of the Sandusky company, Mr. John was appointed acting general manager. He continued serving in that capacity until October 19 last, when he was elected by the Board of Directors to the position of president and general manager.

The new silo storage bins of the Sandusky Cement Co. at its Silica, Ohio, plant have a combined capacity of 300,000 bbls. of cement, and are reported to be the largest storage bins of their kind at any one plant in the world. The Silica plant has been in operation something over six months, and is designed and equipped to produce 12,000,000 sacks of gray cement per year.

New construction at the Sandusky company's Bay Bridge plant has increased its combined storage capacity at that plant to 200,000 bbls.

A survey of the employment situation in Pennsylvania, by the United States Department of Labor, recently made public, indicates that the Lehigh Valley industries are providing steady employment for their many workers. Writing about the Allentown industrial district, which includes the Lehigh Valley, the employment commissioner is quoted as saying the steel mills and plants continue to keep all hands busy. "Cement mills and brick plants are running to capacity," the report says. "Factories in Easton, Allentown and Bethlehem are in need of experienced female operatives. Considerable building is under way throughout the district, and available skilled and unskilled outdoor labor is readily absorbed."